



UTP Home | Search  Advanced



JOURNALS DIVISION
UNIVERSITY OF TORONTO PRESS

Home | Journals Catalogue | Feature Article | UTP JOURNALS online | Publishing Services | Advertise

Published in [University of Toronto Law Journal](#) - Volume LII, Number 4, Fall 2002.

To see more articles and book reviews from this and other journals visit [UTPJOURNALS online at UTPJOURNALS.com](#).

WHY REGULATORS TURN TO TRADEABLE PERMITS: A CANADIAN CASE STUDY[†]

Katrina Miriam Wyman*

i Introduction

For over thirty years, normative economic theory has emphasized the benefits of using tradeable permits to regulate pollution.⁽¹⁾ Beginning with John Dales in the 1960s, economists have argued that distributing permits to pollute, and allowing sources to trade those permits, represents a lower-cost method of reducing pollution than conventional command-and-control regulation.⁽²⁾ Nonetheless, until recently, only the United States had implemented a number of large-scale pollution markets.⁽³⁾ The sharp dichotomy between the us experience with emissions trading and the slow implementation of the concept in other countries was succinctly captured in an international survey on the use of economic instruments in environmental regulation published in 1999: 'The us was the first country to apply tradable permits ... widely ..., and even today, most applications ... can be found in that country,' the survey concluded.⁽⁴⁾

Why has there been a divergence between the United States and other countries in the use of pollution markets? One common, and intuitively appealing, explanation for the greater and faster us embrace of pollution markets emphasizes cultural differences between countries.⁽⁵⁾ According to this cultural hypothesis, the greater us reliance on emissions trading is attributable to an ideological predisposition on the part of Americans toward property rights and markets - and to less comfort with these concepts in other countries.⁽⁶⁾

However, a key purpose of this article is to reject the cultural hypothesis as an explanation for Canada's slow progress in implementing emissions trading. The Canadian experience with pollution markets parallels that of most countries except for the United States. Like many other countries, Canada has been considerably slower than the United States to introduce emissions trading.⁽⁷⁾ However, consistent with developments in Europe⁽⁸⁾ and elsewhere,⁽⁹⁾ the country is now gradually implementing pollution markets⁽¹⁰⁾ and actively considering wider use of emissions trading.⁽¹¹⁾ Moreover, echoing academics from elsewhere, Canadian scholarship has suggested that the country may have been slow to implement pollution markets because

'[i]deologically ... there is less ingrained appreciation of the value of markets in general in ... Canadian political culture' compared with the United States. [\(12\)](#)

This article takes issue in two ways with the notion that Canada has been slow to introduce emissions trading because of national culture. First, I offer a negative argument that attempts to cast doubt on the cultural hypothesis. Specifically, I underscore Canada's significant use of market mechanisms to address another environmental problem: excessive exploitation of fisheries. [\(13\)](#) Notably, commercial fisheries accounting for over half of the value of Canadian fish landings are currently managed through more than forty property rights-based programs analogous to emissions trading. [\(14\)](#) The widespread use of these rights-based programs in Canadian fisheries should count as empirical evidence against the cultural hypothesis for the implementation of property and market mechanisms to protect environmental resources. [\(15\)](#)

Second, and more positively, I take issue with the temptation to attribute Canada's slow progress in implementing pollution markets to culture by offering an alternative, cost-based hypothesis for the delay in introducing tradeable pollution rights. This cost-based hypothesis also addresses the reasons why Canada has been faster to implement property approaches to manage commercial fisheries. In discussing pollution markets, I focus on the principal instance, until recently, in which emissions trading might have been adopted, because Canadian regulators were establishing binding targets for reducing air pollution from multiple stationary sources: the acid rain reduction program initiated in the mid-1980s, which curtailed sulphur dioxide (SO₂) emissions.

I argue that Canada has been slow to implement emissions trading because, in the case of the acid rain control program, the small number of Canadian pollution sources and the informal domestic regulatory process made it possible to partially overcome the information problems that typically undermine the efficiency of conventional regulation. In contrast, given the comparatively large number of fisheries, and of fishers within individual fisheries, regulators have had little realistic possibility of designing regulations that would restrict the extraction of fish at relatively low cost. In short, until recently, there would seem to have been a stronger normative economic case for opting for markets more quickly in the fishing context than in respect of pollution because of different prospects of partially replicating the expected gains from trading, through informal bargaining between regulators and regulated parties.

It should be emphasized that in discussing the significance of the number of resource users and the character of the regulatory process, this article does not reject public choice accounts of the choice of instrument in environmental regulation. [\(16\)](#) As described above, the cost-based hypothesis for the evolution of environmental markets suggests that it may be possible to design cost-sensitive regulation without introducing comprehensive markets, where the number of resource users is small and the regulatory process is informal. By implication, the hypothesis suggests that a small number of resource users and an informal domestic regulatory process may influence the form of regulation demanded by interest groups, such as polluters and fishers, and, in turn, the instruments ultimately supplied by regulators. In particular, where the number of resource users is small and the regulatory process is informal, regulators may be under less pressure from concentrated interests to introduce market mechanisms to realize cost savings, since there may be opportunities for informally bargaining cost-sensitive regulation without implementing comprehensive markets. [\(17\)](#)

In rejecting the cultural hypothesis as an explanation for Canada's record in implementing emissions trading, this article implicitly argues that culture should be revisited as an explanation for the track records of other countries in respect of pollution markets. By itself, this case study of one country's experience with environmental markets is not sufficient to

establish that cultural factors are irrelevant in the choice of instruments for environmental regulation. However, it does suggest that the regulatory frameworks of countries that have been slow to implement emissions trading should be examined contextually before their receptivity to market mechanisms is ascribed to national culture.

The remainder of this article is in five parts. In Part ii, I take issue with the notion that Canada's slowness to introduce pollution markets may have been due to cultural considerations by emphasizing the broad similarity between emissions trading and the individual quota programs used to manage many Canadian commercial fisheries. Parts iii and iv offer an alternative, cost-based hypothesis for Canada's slow progress in implementing pollution markets and more rapid embrace of individual fishing quotas. In Part v, I suggest that my cost-based hypothesis for the implementation of market mechanisms helps to explain the recent interest in pollution markets in Ontario, Canada's most populous and industrialized province.⁽¹⁸⁾ Part vi concludes by briefly discussing the broader implications of my Canadian case study for understanding why regulators implement property and market mechanisms to regulate environmental resources, such as air quality.

ii Individual fishing quotas and emissions trading as economic instruments

The notion that culture may have influenced the pace at which countries have established pollution markets has a respectable intellectual pedigree. In his classic economic account of the emergence of property rights, Harold Demsetz briefly refers to the importance of taking into account 'a community's preferences for private ownership' in explaining the development of property rights.⁽¹⁹⁾ More than twenty years later, Carol Rose similarly implied that the prospects for using market mechanisms to protect the environment might depend in part on the extent to which the 'rhetoric' surrounding these mechanisms resonated.⁽²⁰⁾

But one difficulty with suggesting that Canada has been slow to implement emissions trading because of a culturally rooted suspicion of markets is that Canada has implemented mechanisms comparable to tradeable pollution rights to manage important commercial fisheries.⁽²¹⁾ Since the 1970s, individual quota programs have been introduced gradually in federally regulated ocean fisheries off the Atlantic and Pacific coasts, as well as in provincially managed inland lake fisheries.⁽²²⁾ The bulk of the existing individual quota programs were established in the 1990s,⁽²³⁾ the same period in which emissions trading emerged as a 'star' among policy makers in the United States.⁽²⁴⁾ Indeed, in light of the contrast that the cultural hypothesis assumes between Canadian and us attitudes toward markets, it is noteworthy that, to date, Canada would seem to have introduced considerably more rights-based programs for managing fisheries than the United States.⁽²⁵⁾

Part ii emphasizes the similarities between emissions trading and the individual quota programs used to manage many Canadian commercial fisheries. Both approaches represent property-based regimes for limiting the exploitation of a common pool resource to a fringe of the stock.⁽²⁶⁾ I focus on two rights enjoyed by rights holders under Canada's individual quota regimes, and under paradigmatic pollution permit programs,⁽²⁷⁾ albeit to varying degrees: the right to exploit a specific *quantity* of a resource and the right to *trade* the quantitatively defined right of access.⁽²⁸⁾

a. quantitatively defined rights of access

At the outset, it is important to emphasize that fishers and polluters generally will have enjoyed a right of access before the introduction of an individual quota program or a

marketable pollution permit regime.⁽²⁹⁾ Typically, emitters will have enjoyed a right to pollute the atmosphere by virtue of having obtained a regulatory permit, which will include technology or other input constraints.⁽³⁰⁾ Similarly, fishers likely will have enjoyed a right to exploit a fishery by virtue of having obtained a fishing licence.⁽³¹⁾ This licence, like the permits granted to pollution sources, generally includes command-and-control-style restraints on inputs, such as limits on the size of fishing vessels, fishing gear, or the timing and length of the fishing season.⁽³²⁾ The key distinction between the rights of access enjoyed under conventional regulation and those under emissions trading and individual quota programs is that, under the latter two approaches, the rights are *quantity-* (or *output-*) based rights to release an amount of emissions or to extract an amount of fish.⁽³³⁾

Specifically, in an emissions trading regime, the quantitatively defined rights of access are rights to pollute a portion of the atmosphere.⁽³⁴⁾ These rights are distributed to polluters, generally for free, after the regulator establishes a total allowable amount of pollution for a given time period and then subdivides the amount. Typically, the rights allocated to polluters are denominated in units of emissions, such as tons of sulphur dioxide in the us acid rain program.⁽³⁵⁾

The quantitatively defined rights at the core of individual fishing quota programs are rights to catch a portion of the total allowable harvest of a specific fish population.⁽³⁶⁾ In individual quota systems, regulators establish total allowable catches (tacs) for each covered fish population every year. In turn, rights to portions of the tac are allocated among fishers. In general, the rights to portions of the harvest are denominated as percentages of the tac, rather than in terms of fixed quantities of fish. Allocating rights 'in terms of percentages' means that 'the amount of fish associated with each share automatically varies as total allowable catch varies,' in line with natural fluctuations in fish populations.⁽³⁷⁾ Individual quotas, like tradeable rights in pollution, generally are distributed for free to existing users at the inception of the regime, based on historical levels of resource use.⁽³⁸⁾

b. right to transfer rights of access

Emissions trading and the individual quota programs that Canada uses to manage many of its fisheries are alike not only because they are premised on the distribution of quantitatively defined rights of access to environmental resources but also because they allow for the transfer of the quantitatively defined rights of access. Accordingly, emissions trading and individual transferable quota programs contemplate markets in environmental allowances.⁽³⁹⁾ Put differently, the markets central to emissions trading and individual transferable quota programs are premised on the 'bundle of sticks' these regimes allocate to rights holders.⁽⁴⁰⁾

However, notwithstanding the importance of markets as components of both types of programs, there are differences between the markets that have been established in Canada for fishing quotas and paradigmatic us pollution markets. In general, Canadian markets for individual quotas are more constrained than typical pollution markets, as measured by two closely related factors: the extent of fragmentation in the original design and restrictions on the right to transfer.

1. *Fragmentation in original design*

By comparison with us pollution markets, Canadian markets for fishing quotas tend to be more fragmented in their original design.

Paradigmatic us pollution markets tend to cover large regions. Indeed, in the case of sulphur dioxide, the market covers the nation as a whole.⁽⁴¹⁾ Furthermore, within their sizeable geographic confines, pollution markets tend to apply to many large stationary sources of pollution, albeit sometimes from only one sector of the economy, such as electricity generation under the sulphur dioxide program.⁽⁴²⁾

In contrast, Canadian markets for fishing quotas are fragmented not only by geography, but also along sectoral lines. In general, a quota market covers rights in a single stock of fish,⁽⁴³⁾ located in a specific area, such as a region off the Atlantic or the Pacific, or within a lake.⁽⁴⁴⁾ Furthermore, in Atlantic Canada in particular, separate markets tend to be instituted for the larger fishing enterprises in the offshore fisheries sector and for independent owner-operators in the midshore and inshore fisheries, who use smaller boats. In addition, markets within the inshore fishery may be further fragmented, based on whether fishers use mobile gear or (less expensive) fixed gear.

Consider, for example, the range of markets for groundfish quotas in Atlantic Canada. A region-wide market regulates groundfish taken by large offshore vessels. Several separate sub-regional markets exist for groundfish taken by midshore and inshore vessels, depending on the type of fishing gear used. In the Scotia-Fundy region, for example, one regime regulates various populations of groundfish taken off the southern coasts of Nova Scotia and New Brunswick by inshore vessels (less than sixty-five feet in length)⁽⁴⁵⁾ using mobile fishing gear. The fixed-gear inshore fishery in Scotia-Fundy is managed separately, primarily using community quotas, although individual transferable quota programs also have been established.⁽⁴⁶⁾

There would seem to be at least three reasons for the fragmentation in Canadian fishing quota markets. First, in some instances, separate markets are warranted by the physical separateness of fish stocks. It makes sense to have separate regimes for fish stocks on the Atlantic and Pacific Coasts, for example, because the fisheries on the two coasts are biologically independent. Similarly, establishing separate quotas for individual fish stocks within the Atlantic region, for example, might be considered a response to biological factors. However, in some cases, the existence of separate markets for individual stocks within the same area may be driven by a second consideration: the need for simplicity in defining property rights, in order to facilitate monitoring and trading.⁽⁴⁷⁾ A holistic understanding of some of the fisheries covered by separate markets would likely emphasize that fishing some of the stocks may have implications for other stocks in different regimes, to the extent that the various stocks are interdependent because they are part of a common ecosystem.⁽⁴⁸⁾

Still a third explanation for the fragmentation in Canadian fishing markets is the pressure on regulators to provide equitable access to fisheries for different groups of fishers and fishing enterprises, using vessels and gear of various degrees of sophistication. At least since the advent of limited-entry licensing, there has been a longstanding practice, in Atlantic Canada especially, of breaking down the tac for species based on vessel size, gear type, and geographic area⁽⁴⁹⁾ to address distributional imbalances arising from differences in 'fishing power or proximity to [the] resource.'⁽⁵⁰⁾ Furthermore, establishing separate markets for fishers based on geography, vessel type, and gear size may facilitate the implementation of markets in the first place, by increasing the homogeneity of the fishers covered by individual regimes⁽⁵¹⁾ and by reducing threats to community survival that might arise from wide-open trading.

2. Restrictions on transferability

Complementing the fragmentation in the original design of Canadian individual quota programs are restrictions on the rights to transfer quotas, which outnumber the restrictions on trading in typical pollution markets.⁽⁵²⁾

One type of restriction not present in typical us pollution markets is limitations on the identity of purchasers of allowances. Since paradigmatic us trading programs tend not to restrict the identity of purchasers,⁽⁵³⁾ purchasers may include not only covered sources but parties as diverse as brokerage firms⁽⁵⁴⁾ and environmental groups aiming to retire allowances.⁽⁵⁵⁾ In contrast, Canadian fishing quota programs tend to restrict trading to fishers licensed for the fishery covered by the quota regime.⁽⁵⁶⁾ Accordingly, non-fishers usually are not allowed to purchase rights to the harvest without first acquiring a fishing licence.⁽⁵⁷⁾

A second distinction between paradigmatic pollution markets and Canadian fishing quota markets concerns the existence of restrictions on the mechanisms through which the underlying environmental allowances are exchanged. us pollution markets tend not to restrict the mechanisms of exchange. Accordingly, brokers have developed a wide range of transactions of various degrees of complexity for trading pollution allowances, including outright sales, swaps, allowance loans, and call and put options.⁽⁵⁸⁾ In contrast, individual fishing quotas tend to be exchanged through a smaller range of less sophisticated transactions, and there may be restrictions on the mechanisms through which quotas may be traded. For example, fishers may be limited to selling quotas in conjunction with the sale of a fishing licence. Alternatively, programs that allow fishers to transfer individual quotas without exchanging licences may limit them to temporary sales, under which quotas are sold only for the duration of the fishing season.⁽⁵⁹⁾ Such constraints on the mechanisms through which individual quotas are exchanged have tended to be more prevalent in the initial stages of quota program implementation. Over time, programs that have started by requiring that quotas be sold with licences, or by allowing only temporary in-season trades of quotas, have often relaxed these constraints, as fishers have recognized the benefits of allowing permanent as well as temporary trades in quota alone.⁽⁶⁰⁾

Paradigmatic pollution markets and Canadian fishing quota markets also differ insofar as us pollution markets generally do not include fixed limits on the number of allowances that a single source may acquire.⁽⁶¹⁾ In contrast, fishing quota markets commonly establish a cap on the percentage of the tac that can be owned by a single quota holder.

In general, the restrictions on transferability in Canadian quota regimes might be considered the price that regulators have had to pay in order to secure sufficient support from fishing communities for introducing individual quotas in the first place. Indeed, many of the restrictions on transferability have been included in the face of opposition from regulators, at the instigation of fishers concerned about the distributional implications of allowing trading.⁽⁶²⁾ From the perspective of fishers, restricting the identity of purchasers and limiting permanent sales and quota concentrations help to protect communities from outside 'corporate interests,'⁽⁶³⁾ to minimize the potential for significant growth in income inequalities within communities,⁽⁶⁴⁾ and to limit the likelihood of a 'redistribution of fishing-community locations.'⁽⁶⁵⁾

3. Trading in fishing quotas

In light of the restrictions on transferability in many Canadian individual quota regimes, it must be emphasized that there is active trading in individual quotas in Canada. To illustrate the

existence of trading, I requested information from Canadian fisheries regulators about trading activity in a number of programs. In this section, I briefly consider trading activity levels in two regimes: the Scotia-Fundy regime for inshore groundfish fishers using mobile gear, off the Atlantic coast, and the halibut individual vessel quota program on the Pacific coast. [\(66\)](#)

Both individual quota regimes were implemented in 1991. [\(67\)](#) The Scotia-Fundy regime initially included 325 active licence holders, while the halibut regime originally encompassed 435 active licence-holding vessels. [\(68\)](#) As this last statement implies, individual fishers are licensed (and assigned quotas) in the Scotia-Fundy regime. In contrast, in the halibut regime, licences (and quotas) are attached to vessels. [\(69\)](#)

Notably, both the Scotia-Fundy and the halibut regimes have evolved towards fewer restrictions on transferability over time. From 1991 until 1993, the Scotia-Fundy regime allowed only temporary transfers of quota alone. [\(70\)](#) But even during this period, quota could still be transferred permanently, provided the transfer occurred in conjunction with the sale of a fishing licence. Beginning in 1993, however, permanent transfers of quota alone were permitted, in addition to temporary trading. Among the remaining restrictions on trading, the key ones are the restriction of trading to fishers licensed for the fishery and the existence of a concentration limit. This limit prevents any quota holder from owning more than 2 per cent of the groundfish managed by the program. [\(71\)](#)

Initially, no trading of quota alone was permitted under the British Columbia halibut program, although permanent transfers of quota were allowed in conjunction with the sale of fishing licences. [\(72\)](#) Beginning in 1993, however, temporary, in-season transfers of quota alone were permitted, subject to a concentration limit. [\(73\)](#) In 2000, permanent trading of quota alone was allowed for the first time. [\(74\)](#) As of 2000, permanent and temporary transfers of quota alone are permitted, subject to two principal conditions. [\(75\)](#) First, no one vessel is permitted to own more than 1 per cent of the tac. [\(76\)](#) Second, each licensed vessel must hold a minimum amount of the tac, although this minimum can be temporarily reallocated during the year. [\(77\)](#)

Consider first the trading activity in the Scotia-Fundy regime in the 1999 fishing season. [\(78\)](#) In 1999, fishers in the Scotia-Fundy regime were allowed to harvest nine populations of groundfish, while two populations were closed to fishing because of resource declines. Global quotas, denominated in tonnes, were established separately for each of the nine populations open to fishing. Fishers enjoyed percentage shares of each of the nine global quotas and were able to transfer their individual shares of each global quota separately. Thus a fisher might have transferred his or her percentage share in the global quota for haddock in geographic region 5Z but harvested his or her share of the global quota for flounder in region 4vw. In the case of the two populations closed to fishing in the 1999 season, individual percentage shares were still defined. However, no global quotas were established in tonnes, since the populations were off limits to fishers.

There was considerable temporary trading of individual shares in the nine populations open for fishing. At the low end, 69 per cent of the global quota for redfish in region 2 was temporarily sold for the fishing season, measured in the percentage of tonnes of the global quota traded. At the high end, an exceptional 106 per cent of the global quota for cod located in region 5Z was transferred temporarily. As this figure indicates, individual shares may be transferred more than once, with the result that the transferred tonnage may exceed the entire global quota. There were eighty-three temporary trades for redfish in region 2 and 232 for cod in region 5Z.

Smaller proportions of the global quotas for the nine populations were transferred permanently in the 1999 fishing season. At the low end, approximately 1 per cent of the global quota for flounder in region 4vw was transferred permanently, in sixteen transfers. At the high end, 9 per cent of the global quota for flounder in regions 4X and 5Y was sold permanently, in seventeen exchanges. There also were a small number of permanent sales of individual percentage shares in the two fisheries that were closed, likely as 'part of the transfer of [a] ... licence from [a fisher] ... leaving the fishery.'⁽⁷⁹⁾

The British Columbia halibut regime covers only a single fish population and, accordingly, involves only a single global quota.⁽⁸⁰⁾ As in the Scotia-Fundy regime in 1999, temporary trading was more significant than permanent trading in the halibut regime in the 2000 fishing season. Approximately 59 per cent of the global quota for halibut was traded temporarily, through 428 exchanges. Approximately 7 per cent of the global quota was sold permanently, in seventy-five transactions. Again, as in the Scotia-Fundy regime, the same individual quota may be transferred several times during a single fishing season.

Why might fishers have engaged in the trading activity described above, notwithstanding the existence of restrictions on transferability? As the trading activity suggests, fishers enjoy especially strong incentives to engage in temporary trading. Fishers covered by the Scotia-Fundy regime commonly hold licences for other fish populations in addition to those covered by the regime.⁽⁸¹⁾ Similarly, in the halibut regime, it is common for a vessel to hold licences for multiple fisheries in addition to the halibut fishery.⁽⁸²⁾ Accordingly, once regulators announce the global quotas for the fisheries in which fishers hold licences, fishers are motivated to determine where they should concentrate their resources in order to maximize their net returns. Temporary trades at the beginning of the fishing season enable 'fishermen to adjust the scale of their operations for maximum efficiency'⁽⁸³⁾ and allow 'lower cost fishers to acquire a greater share of the total catch.'⁽⁸⁴⁾ In addition, during the season, temporary trades enable fishers harvesting multiple species to alter their 'quota holdings to adjust to in-season circumstances,'⁽⁸⁵⁾ such as greater success at catching fish from one stock than from another.⁽⁸⁶⁾ Permanent trading enables fishers to obtain compensation in exchange for exiting a fishery. Such trading may be less common than temporary trading not only because of restrictions on transferability but also because fishers may have few incentives to permanently exit fisheries. In many Canadian fishing communities, there are few other employment opportunities.⁽⁸⁷⁾ In addition, as the value of quota holdings has increased in certain fisheries in recent years, fishers have enjoyed a positive incentive to hold onto their quotas, and to trade them only temporarily if they do not intend to fish in a particular fishery in a given year, in the expectation of being able to sell later for a substantial sum.⁽⁸⁸⁾

iii Cost-based hypothesis

Canada's use of market mechanisms to manage commercial fisheries would seem to undercut the notion that the country's slow progress in establishing pollution markets is due to a cultural suspicion of markets, at least as a tool for regulating environmental resources. But if culture does not account for the delays in introducing pollution markets, then how should Canada's slow progress be explained? Moreover, why has the country more rapidly embraced markets to manage fisheries than to manage pollution?

In the remainder of this article, I offer a cost-based explanation for Canada's slow progress in turning to markets to manage pollution and its more rapid embrace of fishing quota markets. This explanation is rooted in the relative ability to partially replicate the benefits of trading in the two contexts, through informal bargaining between regulators and resource users. I begin,

in Part iii, by outlining the normative economic case for markets, as well as several of the key assumptions underpinning it. In Part iv, I suggest that the assumption that there are insurmountable barriers to devising a cost-sensitive regulatory regime for achieving a desired level of resource use did not hold in the principal instance in which Canada might have introduced emissions trading, until recently. In contrast, I argue that this assumption has enjoyed greater currency in the fisheries for longer and, accordingly, that fishing quota markets have been faster to develop because the normative economic case for markets has been stronger in the fisheries, at least until recently. Part v discusses why the appeal of emissions trading recently would now seem to have increased in Canada. I suggest that emissions trading would now seem to be on the regulatory agenda, at least partly, because of the greater difficulty of developing cost-sensitive regulations to address the multi-source pollution problems currently of concern.⁽⁸⁹⁾

a. normative economic case for markets

The principal normative argument for using markets to manage environmental resources emphasizes the welfare gains expected from relying on economic incentives rather than on traditional regulatory methods.⁽⁹⁰⁾ Markets, it is suggested, represent the least expensive means of achieving a given level of resource use with existing technology.⁽⁹¹⁾ In addition, '[f]rom a more dynamic perspective,' markets 'promise additional gains in terms of encouraging the development of more effective and less costly' means of using resources over time.⁽⁹²⁾

In the pollution context, markets are held out as the most efficient means of reducing emissions for two main reasons. First, as discussed above, trading programs allocate quantitative rights to pollute during a given period of time. In so doing, trading programs avoid imposing the uniform emissions performance standards restricting pollution to a specific amount 'per unit of product output[,] or per unit of a particular input,'⁽⁹³⁾ that are characteristic of us,⁽⁹⁴⁾ although not necessarily Canadian,⁽⁹⁵⁾ environmental regulation. The greater flexibility that firms acquire by virtue of obtaining quantitative rights to pollute allows firms to employ a variety of strategies for reducing emissions. For example, electric utilities enjoying quantitative rights to emit sulphur dioxide may select 'among competing technologies,' such as 'scrubbing, fuel blending, fuel switching, [and] clean coal technology.'⁽⁹⁶⁾

The second reason that emissions trading is held out as the least expensive means of reducing pollution concerns the prospect of transferring responsibility for pollution abatement. Perhaps the most common argument for introducing emissions trading is the potential that exists under a trading program for firms to equalize marginal abatement costs by shifting abatement responsibilities among themselves. As Ackerman and Stewart explain, pollution markets exploit variations in abatement costs by creating 'a powerful incentive for those who can clean up most cheaply to sell their permits to those whose treatment costs are highest.'⁽⁹⁷⁾ In so doing, trading should, in theory, 'achieve a least-cost allocation of control for all sources by forcing them to pay the same price for polluting.'⁽⁹⁸⁾

Notably, trading also establishes an incentive for firms to invest in innovative, lower-cost methods for reducing pollution by attaching a monetary value to the right to pollute.⁽⁹⁹⁾ If firms must pay explicitly for the right to pollute, they have an incentive to develop lower-cost abatement technology in order to reduce their emissions and thereby lower the outlays they must incur to pollute. However, firms enjoy an incentive to innovate even if they are allocated a sufficient number of permits for free to cover their emissions, as firms forego revenues when

they use permits instead of selling them.

In the fisheries, markets are held out as the most efficient means of extracting the total allowable catch, not of internalizing the costs of by-products that previously were externalized. Quota programs promise to increase the returns from harvesting a given level of fish for reasons that are broadly analogous to the economic arguments for emissions trading. First, quota programs hold out the promise of welfare gains because they extend secure, quantitative rights to a portion of the harvest. In the absence of quantitative entitlements to the harvest, fishers tend to focus on 'removing fish more quickly than anyone else.'⁽¹⁰⁰⁾ Furthermore, to give themselves a competitive advantage, fishers 'invest in ever-increasing technological means to capture more fish in a stock of ever-declining proportions.'⁽¹⁰¹⁾ Conveying a property right to a portion of the harvest may remove the incentive to invest in harvesting capacity to beat other fishers to the fish and create a new incentive to reduce individual costs of exploitation. In short, under an individual quota system, fishers may be induced to focus on maximizing net returns from their guaranteed quota and thereby to reduce the overcapacity characteristic of common property fisheries.⁽¹⁰²⁾

Second, quota programs hold out the promise of welfare gains, insofar as they permit trades in individual quotas. Trading may increase the net returns from extracting a given level of fish by enabling the most profitable fishers to buy out their less efficient counterparts.⁽¹⁰³⁾ In any given fishing season, temporary trading may enable fishers, who tend to hold licences for more than a single fishery,⁽¹⁰⁴⁾ to focus on the fisheries in which they are likely to make the best returns. Permanent sales represent a 'mechanism by which excess capital can exit from the fishery.'⁽¹⁰⁵⁾

For the purposes of this article, the important point to note is that the normative case for relying on markets to reduce pollution, or to regulate harvesting capacity, rests on several assumptions. I emphasize these assumptions because I suggest that Canada's slow progress in introducing pollution markets might be explained by the failure of at least one of these assumptions to hold true in the Canadian context, at least until recently. In other words, my explanation builds on the normative assumption that markets *will* produce cost savings by comparison with traditional regulatory methods. I suggest that markets in environmental resources arise *because* they are likely to generate cost savings by comparison with other possible regulatory approaches.⁽¹⁰⁶⁾

b. assumptions

1. Targeted level of resource use

Among the assumptions undergirding the argument for markets is that regulators have agreed upon a desirable level of resource use. In the absence of an *a priori* decision to limit resource use, there would seem to be little incentive to establish a market, since markets will not generate cost savings by comparison with other forms of regulation.⁽¹⁰⁷⁾ Indeed, no form of regulation, whether market-based or conventional command-and-control, is likely to emerge in the absence of a targeted level of resource use.

A corollary is that the normative case for markets presumably rises as the pollution control objective increases in stringency or the total allowable catch declines. This is because the aggregate savings associated with relying on markets, as opposed to conventional regulation, likely increase as it becomes more expensive for individual resource users to achieve the targeted level of use. In the pollution context, for example, once the least expensive means of reducing pollution are eliminated, it will likely be considerably costlier to achieve more

stringent reductions in emissions absent markets allowing higher-cost abaters to transfer pollution control to lower-cost abaters. [\(108\)](#)

2. Cost heterogeneity

Another important assumption underpinning the case for markets is that there are variations in costs among 'resource exploiters' [\(109\)](#) in harvesting resources in an extractive industry such as fishing, or in restraining resource use in the pollution setting. [\(110\)](#) As Cropper and Oates explain, '[t]he source of the 'large cost savings' associated with using economic incentives to manage pollution 'is the capacity of economic instruments to take advantage of ... large differentials in abatement costs across polluters.' [\(111\)](#) The uniform emission rates or performance standards characteristic of conventional command-and-control are economically deficient because they require 'polluter A ... to cut back his own wastes even if it is cheaper for him to pay his neighbor B to undertake the extra cleanup instead.' [\(112\)](#) In a similar vein, the argument for individual transferable fishing quotas rests on the assumption that there are variations in harvesting costs. Transferability is intended to allow low-cost producers to buy out high-cost producers. [\(113\)](#) Allowing low-cost producers to expand their share of the harvest is expected to reduce the excess harvesting capacity characteristic of common property fisheries and thereby improve returns from the fisheries.

3. Information barriers

Still a third assumption underpinning the case for markets is that regulators face an information problem related to the cost differentials confronting resource users. Specifically, regulators are assumed to be unable to acquire sufficient information about the different costs faced by resource users to develop a regulatory framework that takes these cost differentials into account.

In the pollution context, regulators are presumed to lack sufficient information about variations in compliance costs to ensure that individualized pollution control targets are imposed on polluters in line with their relative abatement costs. Instead, reflecting their ignorance of compliance costs and of other factors such as interest group pressures, regulators are assumed to impose uniform requirements on polluters. In turn, these uniform requirements are presumed to increase the overall cost of reducing pollution above the cost-minimizing amount. [\(114\)](#)

Similarly, in the fisheries, regulators are assumed to lack sufficient information about individual fishers' options for increasing harvesting capacity to devise a regulatory strategy that limits capacity to the level that would maximize net returns from extracting the total allowable catch. In a fishery where the total catch is restricted to protect resource levels, rents are likely to be dissipated because fishers, lacking rights to a specific quantity of the harvest, are motivated to increase their individual fishing effort to maximize their share of the catch. [\(115\)](#) Historically, regulators have attempted to maximize net returns from the fishery by controlling fishing effort through controls on inputs, such as the number of fishers or vessels. However, fishers have generally responded by increasing their use of unrestricted inputs, such as bigger and faster vessels or more powerful fishing gear, or by directing their inputs at unregulated fisheries. [\(116\)](#) In turn, the inevitable response from regulators has tended to generate another round of substitution activity, and then additional regulation. [\(117\)](#) As regulators themselves have acknowledged, 'effort controls have not restrained capacity growth.' [\(118\)](#) Pearse alludes to the underlying information problem in his 1982 report on the Pacific fisheries, explaining that

while, theoretically, restrictions could be placed on all dimensions of fishing effort simultaneously, such restrictions would have to be ... numerous and diverse (covering vessel size, power, crew, time spent fishing, gear for finding, catching and holding fish, and so on)....[\(119\)](#)

Moreover, there is another difficulty with relying on input controls to limit fishing capacity, apart from the problems caused by regulators' incomplete information about the range of options fishers enjoy for increasing capacity. This second difficulty arises from the fact that certain forms of effort controls compromise efficiency in the fisheries. For example, limits on the length of the fishing season and on the quantity of fish that can be caught during a single trip tend to 'promote inefficiency by keeping productive capacity from producing.'[\(120\)](#) Similarly, limits on the size of replacement vessels impede future improvements in technical efficiency by preventing fishers from adjusting the size of their boats.[\(121\)](#)

But what if pollution regulators, in particular, were able to partially overcome the information problems and to obtain sufficient information to implement a cost-sensitive regulatory framework? In this instance, the idea of establishing a market would presumably hold less appeal.

Other assumptions undergird the normative case for markets, in addition to the assumptions discussed above concerning the existence of a desired level of resource use, cost heterogeneity, and information problems facing regulators.[\(122\)](#) However, I have emphasized these three because I hypothesize that Canada may have been slow to implement pollution markets because, in the principal instance until recently in which Canada might have introduced emissions trading, the small number of pollution sources and the informal domestic regulatory process may have facilitated partially overcoming the information problems that typically prevent command-and-control regulation from restraining resource use in a cost-sensitive manner.

iv Relative ease of replicating gains

Part iv argues that Canada has been slow to introduce pollution markets, and faster to embrace individual fishing quotas, because of the relative ease of partially replicating the gains that environmental allowances promised in the two contexts.

My discussion of the pollution context concerns the principal instance, until recently, in which Canada might have implemented emissions trading: the program of reducing sulphur dioxide emissions initiated in the mid-1980s to curtail acid rain. In this instance, Canadian regulatory policy satisfied perhaps the most fundamental condition for implementing emissions trading: the adoption of a binding, targeted level of resource use covering multiple sources. The program of reducing sulphur dioxide emissions to address acid rain was formally initiated in 1985, when the federal government, and the seven eastern Canadian provinces most vulnerable to the environmental effects of acid deposition, agreed on a formula for lowering eastern Canadian emissions by 50 per cent, by comparison with 1980 levels, by 1994.[\(123\)](#) While the possibility of using emissions trading was not discussed extensively in the mid-1980s, trading was nonetheless considered as an option for achieving the targeted reductions.[\(124\)](#)

Apart from the acid rain control program initiated in the mid-1980s, there would not seem to have been another instance, until recently, of Canadian regulators establishing binding targets for reducing emissions from multiple stationary sources relatively simultaneously. However, the policy agenda now embraces several pollution problems that are candidates for emissions

trading, since they are caused in part by emissions from multiple stationary sources. These include emissions of nitrogen oxides (NO_x) causing smog, emissions of greenhouse gases, and, once again, sulphur dioxide emissions, given that four of the eastern Canadian provinces have initiated steps toward a second round of SO_2 reductions to address acid rain. ⁽¹²⁵⁾ To be sure, smog and climate change have been on the policy agenda for several years. Indeed, the possibility of using emissions trading to control emissions of nitrogen oxides and greenhouse gases has already been examined in Canada. ⁽¹²⁶⁾ But, again, there has been relatively little meaningful action at either the federal or provincial levels, until recently, to address issues such as emissions of nitrogen oxides or greenhouse gases, for which markets might be established. ⁽¹²⁷⁾

I set out in three sections my hypothesis that Canada's slower progress in introducing emissions trading than in introducing individual fishing quotas is attributable to the possibility of partially replicating the benefits of pollution markets through negotiation in the mid-1980s, due to the small number of pollution sources and the informal domestic regulatory process.

Section A emphasizes that tradeable rights held out the potential of reducing the costs of controlling sulphur dioxide emissions in the mid-1980s and early 1990s and of improving net returns from the fisheries.

Section B turns specifically to the potential for partially replicating the benefits held out by trading in the air pollution and fisheries contexts. This section begins by discussing the theoretical significance of Canada's small number of pollution sources and the informal Canadian regulatory process for the prospects of designing cost-sensitive regulation without introducing comprehensive markets. The section then provides an indication of the number of sources of sulphur dioxide in Canada and the number of fishers in the fisheries in which individual fishing quotas have been implemented.

Section C addresses the efficiency of the regime implemented in the mid-1980s to reduce sulphur dioxide and the fishing quota programs gradually established in Canada in the past thirty years. Turning first to the sulphur dioxide regime, I argue that the regulatory framework developed in the 1980s was sensitive to variations in abatement costs, although not perfectly efficient. In other words, I suggest that the regulatory framework implemented in the 1980s was consistent with my expectation that a small number of resource users and an informal regulatory process may be conducive to developing regulation that is cost sensitive, if not perfectly efficient. I then underscore the efficiency gains that individual quotas would seem to have generated in the fisheries, where the large number of fisheries, and of fishers within individual fisheries, may implicitly have encouraged a more rapid embrace of environmental allowances.

a. potential gains

In this section I make the case that trading held out the promise of reducing the costs of achieving the sulphur dioxide reductions announced in the mid-1980s, by comparison with conventional command-and-control regulation. In addition, I emphasize the magnitude of the gains expected from implementing individual fishing quotas.

I begin with the expected gains from trading rights to emit sulphur dioxide and individual fishing quotas because it is important to underscore that tradeable rights promised benefits in both contexts. I emphasize this point in part to clarify that I am not arguing that Canada has been slow to introduce pollution markets because they have not held out the promise of benefits, or because the potential gains from emissions trading were less than the sum of the gains expected from implementing the various quota markets currently in existence in

Canada. [\(128\)](#)

1. Sulphur dioxide

At the outset, it is important to emphasize that sulphur dioxide trading offered the potential for significant cost savings in the mid-1980s, when Canada initiated the first round of sulphur dioxide reductions to address acid rain. This is because there is evidence from the 1980s and 1990s of significant variations in abatement costs among the large Canadian sources of sulphur dioxide. As discussed above, it is such variations that trading exploits to generate cost savings. As Ackerman and Stewart explain, '[a] system of tradeable rights will tend to bring about a least-cost allocation of control burdens.' [\(129\)](#)

To be sure, one factor that might have reduced the cost savings generated by emissions trading in 1985 is the strong likelihood that trades would have been allowed only among sources located within the same province, or within small groupings of provinces. The federal government likely enjoys the constitutional jurisdiction to introduce a national trading regime for a pollutant such as sulphur dioxide that travels across provincial and national boundaries. [\(130\)](#) In practice, however, sulphur dioxide trading has tended to be considered by regulators as an instrument that would be implemented at the provincial level or, possibly, through a joint federal-provincial initiative. [\(131\)](#) To a significant extent, the focus on provincially managed trading regimes reflects the limited role that the Canadian federal government has traditionally played in environmental matters and the provinces' role as the primary regulators of pollution sources. [\(132\)](#) In addition, the focus on provincial regimes may also be consistent with the regional environmental impacts of sulphur dioxide emissions, although only insofar as these correspond with provincial boundaries. [\(133\)](#)

Still, it must be emphasized that emissions trading might have been expected to generate significant cost savings due to variations in abatement costs, even if it had been permitted only within individual provinces or groupings of provinces. Consider, for example, the variations in abatement costs in Ontario, the province that accounted for the single largest percentage of eastern Canadian emissions in 1980 (46 per cent) and continues to do so today (37 per cent in 1997). [\(134\)](#) In the early 1980s, there were two categories of sources of sulphur dioxide emissions in Ontario, based on expected abatement costs. On the one hand, there were a number of polluters that could be expected to reduce their emissions at a relatively low cost per tonne of sulphur dioxide removed, principally the facilities owned by Algoma, Falconbridge, and Inco. [\(135\)](#) Other sources, on the other hand, could be expected to face comparatively high costs per tonne of sulphur dioxide removed, principally the fossil fuel-fired generating plants operated by Ontario Hydro (the provincially owned utility) and several oil refineries. [\(136\)](#) Indeed, in 1985, an economist in the Ontario Ministry of the Environment proposed an emissions trading regime that would have exploited the significant variations in abatement costs among Algoma, Falconbridge, Inco, Ontario Hydro, and the refineries. At the time, he estimated that his Ontario-only emissions trading regime might achieve a provincial ceiling of 494 kilotonnes at a cost of \$342 million per year less than would have prevailed under 'pro-rata emission standards' mandating reductions at individual sources. [\(137\)](#)

Furthermore, it seems likely that cost savings would have resulted in the 1980s and 1990s from allowing trading within the four Atlantic provinces. Sources in these provinces account for a significantly smaller percentage of eastern Canadian emissions than sources in Ontario: 12 per cent in 1980 and 21 per cent in 1997. [\(138\)](#) Nonetheless, a 1995 study based on information from sources in the region about their abatement costs [\(139\)](#) seemed to confirm that there were sufficient variations in abatement costs in the Atlantic for trading to have generated cost

savings, at least in the early 1990s.⁽¹⁴⁰⁾

2. Fisheries

Why might individual fishing quota programs have been expected to generate significant aggregate gains? The principal reason is the overcapacity that has 'plagued'⁽¹⁴¹⁾ many fisheries, in Canada and elsewhere, for decades. Overcapacity arises when either capital (the number of fishing vessels and their technological capability) and/or labour (the number of fishers) exceeds the level that would maximize social welfare.⁽¹⁴²⁾ The consequences of overcapacity include not only a 'waste of labor and capital in redundant catching capacity' but also 'depressed incomes and, generally, the poor economic performance of open-access, common property fisheries.'⁽¹⁴³⁾

Since the early 1980s, a series of government-commissioned reports recommending individual quotas have offered estimates of the overcapacity they have unanimously characterized as a 'central ... problem' in Canadian fisheries.⁽¹⁴⁴⁾ In global terms, these reports have estimated industry overcapacity in the Atlantic and Pacific fisheries at approximately 50 per cent.⁽¹⁴⁵⁾ Analyses of industry capacity in specific fisheries have produced significantly higher estimates of excess capacity. For example, a capacity analysis undertaken in the late 1980s estimated that the Scotia-Fundy inshore groundfish fleet of 2 300 fixed-gear and approximately 400 mobile-gear vessels had twice the capacity needed to harvest available groundfish resources. Furthermore, the analysis suggested that the fleet had four times the fishing power needed to harvest available groundfish, if the 1 000 vessels licensed for groundfish but harvesting other species at that time were counted as part of the fleet.⁽¹⁴⁶⁾ Presumably, removing the costs associated with carrying excess capacity of 50 per cent or more would significantly improve net returns from fisheries.⁽¹⁴⁷⁾

As discussed above, individual quota programs promise to generate welfare gains, by reducing overcapacity, in at least two ways.⁽¹⁴⁸⁾ First, by providing fishers with exclusive rights to a specific quantity of fish, individual quotas remove the incentive for fishers 'to improve their individual positions'⁽¹⁴⁹⁾ by increasing their fishing capability relative to others 'until the total harvesting costs have risen to the level of total revenue.'⁽¹⁵⁰⁾ Second, the transferability of individual quotas enables low-cost harvesters to displace their high-cost counterparts.

b. potential for replicating expected gains

Why might regulators have implemented rights-based programs for fisheries but not for sulphur dioxide in the mid-1980s, even though environmental allowances held out the promise of sizeable welfare gains in both contexts, relative to typical command-and-control regulation? As discussed above, the normative economic case for markets presumes that regulators, because of information deficiencies, are unable to devise an efficient regulatory framework for achieving a desirable level of resource use. As Ackerman and Stewart explain with respect to pollution control, one of 'marketability's great administrative advantages'⁽¹⁵¹⁾ is that 'it allows inevitably ill-informed bureaucrats to avoid technological and economic decisions best made by the people operating the plants.'⁽¹⁵²⁾

My hypothesis is that pollution markets have been slow to develop in Canada because, in the principal instance until recently in which tradeable pollution rights might have been adopted, regulators were able to partially overcome the information problems that generally undermine the efficiency of command-and-control regulation. In particular, I suggest that they were able to do so because of the small number of major Canadian sources of sulphur dioxide emissions

and the informal domestic regulatory process. Conversely, I argue that the large number and diversity of Canadian fisheries, and the large numbers of fishers within individual fisheries, have made it more difficult to develop an efficient conventional regulatory strategy for controlling harvesting capacity and, accordingly, have provided a stronger impetus for more rapidly embracing individual fishing quotas.

Why might the small number of pollution sources covered by the acid rain control program, combined with the domestic regulatory process, have made it possible to partially overcome the information problems facing regulators? In theory, a small number of sources should reduce the information burden on regulators by reducing the resources required to compile data about expected abatement costs and to formulate source-specific pollution targets.⁽¹⁵³⁾ Moreover, an informal regulatory process, like the one that exists in Canada, should increase the feasibility of developing cost-sensitive, source-specific standards. In Canada, in contrast to the United States, regulations are not established through formal notice and comment rule-making.⁽¹⁵⁴⁾ By American standards, regulated interests - and public interest groups - in Canada enjoy few opportunities to judicially review the process and the substance of environmental regulations.⁽¹⁵⁵⁾ Accordingly, the Canadian regulatory process may be more conducive to developing source-specific regulatory standards, since regulators face little prospect of having to defend individualized pollution control targets against judicial scrutiny.⁽¹⁵⁶⁾

Nonetheless, a caveat is in order about the potential for replicating the benefits of markets even in the best case scenario, where there is a small number of polluters and an informal regulatory process. Even in such a scenario, the resultant regulatory framework is likely to be at best an imperfect approximation of the allocation that might be achieved under market conditions. This is partly because regulators are unlikely to be able to perfectly allocate the pollution control burden *ex ante* in line with variations in abatement costs, because of the difficulty of acquiring reliable information about these costs before a pollution control program is implemented, as well as because of political pressures from regulated interests. In addition, without markets, polluters will be unable to reallocate responsibility for pollution control among themselves to take into account changes in relative compliance costs over time. Moreover, sources will enjoy fewer incentives to develop innovative lower-cost abatement technologies because polluters will be unable to profit by selling surplus rights.

Still, it should be emphasized that a pollution market that covers only a limited number of sources may not be suited to fully realizing the theoretical benefits of emissions trading. There are likely to be a small number of transactions in a market covering only a small number of polluters, since the number of market participants is limited. In turn, in a thin market, the lowest-cost abaters may not assume their ideal share of the pollution control burden, and there may be limited incentives to innovate, because of the lack of market liquidity. Moreover, there may be greater cause for concern about market power in a small market.⁽¹⁵⁷⁾ Accordingly, the normative case for implementing markets where the number of sources is small may be weaker, even apart from the potential that small numbers may create for partially replicating the benefits of markets.

The remainder of this section provides an indication of the number of pollution sources covered by the acid rain control program initiated in the 1980s and the larger number of fishers that may have contributed to the more rapid embrace of environmental allowances in that area.

1. Sulphur dioxide

There are at least three different ways of illustrating the small number of large sources of

sulphur dioxide in Canada in the early 1980s (and even today). One measure is the small number of corporations accounting for a significant percentage of eastern Canadian emissions. In 1980, eight corporations accounted for approximately 75 per cent of sulphur dioxide emissions in the seven eastern Canadian provinces.⁽¹⁵⁸⁾ A second measure of the small number of Canadian sources is the number of emitting facilities⁽¹⁵⁹⁾ rather than the number of polluting firms. In 1980, approximately 75 per cent of eastern Canadian sulphur dioxide emissions came from twenty-two large point sources.⁽¹⁶⁰⁾ Still a third measure of the small number of large sources is the number of large point sources owned by each of the dominant polluters. For the sake of clarity, I provide this information in Appendix B. In 1980, the top three emitters owned two, three, and five large point sources, respectively, in eastern Canada.

The small number of large SO₂ sources within Ontario is worthy of particular note, in light of the tendency to regulate pollution at the provincial, rather than the national, level and of the fact that Ontario accounted for almost half of eastern Canadian sulphur dioxide emissions in 1980.⁽¹⁶¹⁾ Within Ontario, four corporations operating eight large point sources accounted for 85 per cent of total provincial emissions in 1980. Inco, the dominant source, accounted for 46 per cent of provincial emissions in 1980 through its smelting facilities in Sudbury. The next largest source, Ontario Hydro, owned five fossil fuel-fired generating facilities that accounted for 23 per cent of provincial emissions in 1980.⁽¹⁶²⁾

The small number of large sources of sulphur dioxide made it conceivable that regulators might be able to acquire sufficient information at reasonable cost about the expected abatement strategies, and relative compliance costs, of the sources to devise a cost-sensitive allocation. However, the task of developing a cost-sensitive allocation might have been more complex had there been an expectation that the number of sources would grow significantly in the future. If there had been an expectation of growth, then a cost-sensitive regulatory program would have needed to allocate a portion of the pollution ceiling to the new sources, based on their expected abatement costs. In turn, predicting the number of new sources, and their relative abatement costs, likely would have complicated the development of a cost-sensitive allocation *ex ante*, especially if the identity of the new sources was unknown.

In the early 1980s, however, there was little expectation that the number of large Canadian sources of sulphur dioxide would be expanding significantly in the future. While it was expected that sulphur dioxide emissions from the large Canadian smelters might rise in line with production increases in the absence of additional abatement measures, there was little expectation that the overall number of smelters would increase.⁽¹⁶³⁾ Moreover, there was little expectation of a significant increase in the number of coal-fired generating plants in the near term, partly because of the importance of hydroelectric power and nuclear energy as sources of electricity in Canada.⁽¹⁶⁴⁾

Notably, in retrospect, these expectations about a relatively static number of sources proved accurate. In 1997, for example, the same eight corporations still accounted for 69 per cent of eastern Canadian sulphur dioxide emissions, and the number of large sources that they owned had increased by only two since 1980, to twenty-four.⁽¹⁶⁵⁾

2. Fisheries

While eight corporations owning twenty-two large point facilities accounted for the bulk of Canadian sulphur dioxide emissions in the early 1980s, Canadian fisheries regulators have consistently been confronted with a significantly larger number of resource exploiters. The operative numbers for comparative purposes would seem to be the number of fisheries in which individual quota programs have been implemented and the number of economically

distinct parties that initially received quota entitlements when these quota programs were established. I focus on these indicators because they suggest the number of negotiations that would have been required between regulators and fishers, and the number of parties that would have been involved in individual negotiations, if regulators had attempted to replicate the benefits of quota programs through informal bargaining and conventional regulation.

To begin, an approximate indication of the number of negotiations that would have been required to replicate the benefits of quota programs is provided by the number of individual quota regimes that have been established in Canada. [\(166\)](#) As mentioned above, there are currently more than forty individual quota regimes, covering a diverse range of fisheries on the Atlantic and Pacific coasts as well as provincially managed inland lake fisheries. Presumably, the diversity of the fisheries under individual quota management would have further added to the difficulties associated with replicating the benefits of property-based mechanisms through conventional regulation. [\(167\)](#)

To be sure, the more than forty sets of negotiations that would have been required to replicate the benefits of property-based mechanisms would not have been undertaken by a single regulatory bureaucracy, as responsibility for fisheries management is divided between the federal and provincial governments. Nonetheless, federal fisheries regulators would have been required to undertake the bulk of the negotiations, albeit through a decentralized bureaucracy. [\(168\)](#) Only eight of the existing individual quota regimes were established by provincial regulators. The remainder apply to ocean fisheries under federal jurisdiction on the Atlantic and Pacific coasts.

Moreover, a factor that would have further complicated efforts to replicate the benefits of property and market based mechanisms through conventional regulation is the number of individual fishers, or fishing enterprises, within the fisheries in which individual quota regimes have been established. I have compiled information about the number of fishers and fishing enterprises initially allocated individual quotas in fifty-six Canadian individual quota regimes. [\(169\)](#) Of these fifty-six individual quota programs, only six began by allocating rights to eight or fewer distinct entities. [\(170\)](#) In other words, it would seem that regulators have resorted to individual quota programs in only six instances where developing an efficient conventional regulatory regime would have involved negotiating with the same number of individuals or enterprises, or fewer, as there were major corporate sources of sulphur dioxide in eastern Canada in the early 1980s. [\(171\)](#) Indeed, the median number of initial quota holders in the fifty-six programs was thirty-four. Thirteen programs included more than eighty-one initial quota holders. For greater clarity, a graph outlining the distribution of the initial number of quota holders in the fifty-six programs is included as Appendix D.

c. efficiency of acid rain control program and individual quota

regimes

In this article I suggest that both Canada's approach to reducing sulphur dioxide emissions, beginning in the mid-1980s, and the individual quota regimes used to manage many commercial fisheries have been sensitive to costs. In this section, I attempt to illustrate the extent to which the approach developed by regulators in consultation with polluters in the mid-1980s partially replicated the benefits that might have accrued from introducing comprehensive emissions trading. In addition, I consider the extent to which individual quota regimes have improved the efficiency of commercial fisheries.

1. Sulphur dioxide

To a surprising extent, regulators would seem to have realized the possibility afforded by the small number of significant sources of sulphur dioxide, and by the informal Canadian regulatory process, to develop a program that was not crudely insensitive to differences in abatement costs. For analytical purposes, several elements of the regulatory program implemented in 1985 should be distinguished, although in practice these elements would seem to have evolved simultaneously. These are the extent to which regulators acquired information about the expected abatement costs of the sources of sulphur dioxide and the extent to which each of the inter-provincial, and the intra-provincial, allocations reflected expected differences in abatement costs.

To begin with, it is worth emphasizing that the Canadian regulators who devised the acid rain program appear to have overcome, to a notable extent, the information problems that are assumed to undermine the efficiency of conventional regulatory approaches. Indeed, both the federal government and Ontario developed databases that included information about the expected abatement costs of individual sources and about source-receptor relationships. [\(172\)](#) Ontario's database proved the more influential, since Ontario, rather than the federal government, played the lead role in negotiating the inter-provincial allocation. [\(173\)](#) This database included site-specific abatement cost estimates for the major Ontario sources. [\(174\)](#) 'Generic cost estimates' were used for other Canadian sources, such as power plants outside Ontario. [\(175\)](#)

Of greater importance than the extent to which regulators compiled information about differences in expected abatement costs is the extent to which the ultimate allocation of pollution control responsibilities reflected these differences in expected costs. In this regard, consider first the allocation among the eastern Canadian provinces of the target of reducing 1980 emission levels by 50 per cent by 1994. [\(176\)](#) Notably, relatively early in the process of allocating this target among themselves, the eastern Canadian provinces explicitly rejected rigid command-and-control approaches to reducing emissions, such as requiring sources to adopt the best available technology or to uniformly reduce emissions by 50 per cent, on the grounds that these approaches would be 'unnecessarily expensive.' [\(177\)](#) Instead, the provincial environment ministers set themselves the task of apportioning responsibility for abatement 'based on a most cost effective, receptor oriented strategy.' [\(178\)](#) Under this strategy, responsibility for reducing emissions would have been allocated 'in a way that [would] minimize[] [abatement] costs and maximize[] the benefits for environmentally endangered areas.' [\(179\)](#) In other words, reductions would have been allocated to lower deposition levels in sensitive receptor areas, at the lowest possible cost. Since the 'most cost effective, receptor oriented' criterion incorporated both compliance costs and the environmental impacts of reductions, it arguably would have been superior, from a societal perspective, to a formula considering abatement costs alone. [\(180\)](#) Ultimately, however, the provincial ceilings were not allocated neatly based on the ideal of the most cost-effective, receptor-oriented strategy, perhaps because the inter-provincial allocation was dominated by political, rather than technocratic, actors. [\(181\)](#)

Nonetheless, the final inter-provincial allocation seems to have corresponded to a surprising extent with the most cost-effective, receptor-oriented inter-provincial allocations generated by Ontario's database. [\(182\)](#) Between 1982 and 1985, many potentially 'ideal' inter-provincial allocation scenarios were generated by the Screening Model that Ontario developed, using data the province compiled on source-receptor relationships and abatement costs at individual sources. [\(183\)](#) The small number of ideal inter-provincial allocation scenarios that I have reviewed [\(184\)](#) suggest that so₂ emission reductions should have been concentrated in three

provinces: Ontario (which was responsible for 46 per cent of eastern Canadian emissions in 1980), Quebec (29 per cent), and Manitoba (13 per cent).⁽¹⁸⁵⁾ Moreover, these scenarios indicate that reducing eastern Canadian emissions in line with the most cost-effective, receptor-oriented strategy would have required Ontario to assume responsibility for a greater share of the eastern Canadian reduction burden than its share of eastern Canadian emissions in 1980.⁽¹⁸⁶⁾ Quebec and Manitoba should have been responsible for considerably lower shares of the overall eastern Canadian reduction burden than Ontario.⁽¹⁸⁷⁾

The reductions that provinces were required to undertake from 1980 emission levels to achieve the 1994 eastern Canadian emission limit suggest that Ontario assumed a greater share of the overall eastern Canadian reduction burden than its share of 1980 emissions. In particular, Ontario would seem to have assumed responsibility for approximately 60 per cent of the reductions required to achieve the 1994 eastern Canadian cap,⁽¹⁸⁸⁾ although, as mentioned above, the province accounted for only 46 per cent of eastern Canadian emissions in 1980. This 60 per cent share of eastern Canadian reductions is roughly in line with Ontario's share of the eastern Canadian reduction burden under two of the ideal inter-provincial allocation scenarios that I reviewed.⁽¹⁸⁹⁾ However, by comparison with the ideal inter-provincial allocation, Quebec may have assumed responsibility for an excessively large share,⁽¹⁹⁰⁾ and Manitoba an insufficiently large share, of the eastern Canadian reduction burden.⁽¹⁹¹⁾

How was the roughly 60 per cent reduction burden that Ontario would seem to have assumed, in line with the most cost-effective, receptor-oriented strategy, allocated among the province's sources of sulphur dioxide? Here, too, there is evidence that the ultimate intra-provincial allocation in Ontario, at least, was more sensitive to compliance costs than is conventionally assumed to be the case in the absence of emissions trading.⁽¹⁹²⁾ In effect, the distribution of Ontario's provincial cap focused on the shares that would be assumed by the province's two major sources, Inco and Ontario Hydro, which together accounted for 69 per cent of Ontario emissions in 1980.⁽¹⁹³⁾

Of these two sources, Inco was by far the lowest-cost abater.⁽¹⁹⁴⁾ As mentioned above, it was responsible for approximately 46 per cent of Ontario emissions in 1980 through its smelting facilities in Sudbury.⁽¹⁹⁵⁾ In line with its lower abatement costs, Inco ultimately was allocated 63 per cent of the provincial emission reduction burden, an amount 17 per cent greater than its share of Ontario emissions in 1980.⁽¹⁹⁶⁾

Ontario Hydro, a considerably higher-cost abater than Inco,⁽¹⁹⁷⁾ operated fossil fuel-fired generating plants that accounted for 23 per cent of provincial emissions in 1980.⁽¹⁹⁸⁾ Reflecting Inco's greater share of the provincial reduction burden compared with its share of 1980 emissions, Ontario Hydro was allocated only 25 per cent of the reduction burden.⁽¹⁹⁹⁾ Moreover, Ontario Hydro not only benefited from an intra-provincial allocation that assigned it a share of the provincial reduction burden only 2 per cent greater than its share of provincial emissions in 1980 but also obtained other elements of flexibility not conventionally associated with crude command-and-control regulation. In particular, at its insistence, Ontario Hydro was assigned a reduction target in the form of a corporate cap on emissions, which enabled it to trade emissions among its multiple power plants.⁽²⁰⁰⁾ In addition, again at its request,⁽²⁰¹⁾ Ontario Hydro was initially allowed to engage in intra-firm, inter-temporal trading, as it was permitted to bank unused emissions for future years.⁽²⁰²⁾ However, the privilege to bank emissions was withdrawn in 1987,⁽²⁰³⁾ perhaps in part because of objections from environmentalists.⁽²⁰⁴⁾

The latitude to trade emissions among power plants, also enjoyed by multi-facility utilities in two other provinces, [\(205\)](#) likely contributed to reducing the costs of achieving the eastern Canadian reductions. Indeed, in the United States, internal trading would appear to have been the major source of cost savings in the early years of the acid rain trading program, notwithstanding the availability of inter-firm trading. [\(206\)](#) Over time, however, the significance of trading between 'economically distinct entities' has increased considerably under the sulphur dioxide program. [\(207\)](#) Accordingly, by the end of 1999, approximately 38% of the so₂ allowances transferred under the program had been exchanged between distinct organizations. [\(208\)](#)

In sum, the eastern Canadian acid rain control program initiated in 1985 did not represent a crude version of command-and-control regulation. To a surprising extent, regulators obtained estimates of the expected abatement costs of the major sources. Furthermore, these estimates were used in allocating the pollution control burden, and the ultimate allocation of that burden reflected differences in expected abatement costs. Still, it must be acknowledged that the program was deficient from a cost-based perspective. While the allocation certainly was sensitive to cost differences among the sources, it did not achieve the economic ideal of equalizing marginal abatement costs among the eastern Canadian sources of sulphur dioxide. [\(209\)](#) In addition, until it recently became apparent that regulators would impose a second round of sulphur dioxide reduction targets, [\(210\)](#) there was little incentive, in the absence of markets, for the major sources to develop innovative, lower-cost abatement measures after the late 1980s and early 1990s. Moreover, without markets, it has been impossible for the principal sources of sulphur dioxide to reallocate responsibility for limiting sulphur dioxide emissions among themselves to reflect changes in their respective abatement costs over time. [\(211\)](#) But it must be emphasized that markets rarely achieve 'the formal least-cost result' [\(212\)](#) and that any emissions trading market that might have been implemented in eastern Canada in the 1980s would have been thin, given the limited number of pollution sources. [\(213\)](#)

2. Fishing quotas

To what extent have the sizeable gains promised by markets in fishing quotas been realized in practice? Surprisingly, there would seem to be few detailed empirical studies assessing changes in efficiency in the same fishery following the creation of individual quota programs. [\(214\)](#) Nonetheless, there have been studies examining changes in efficiency following the introduction of individual vessel quotas in the British Columbia halibut fishery, [\(215\)](#) as well as enterprise allocations in the offshore scallop fishery in Atlantic Canada. [\(216\)](#) Both of these studies concluded that the quota regimes have generated efficiency gains, although the study of the halibut program suggested that it would have generated additional gains if it had contained fewer restrictions on transferability. [\(217\)](#)

One proxy for improved efficiency in the fisheries that is reasonably well documented is the drop in the number of active vessels following the introduction of individual quota programs. [\(218\)](#) Consider, for example, the decline in the number of active vessels in the halibut and Scotia-Fundy regimes by 2000 and 1998, respectively, since the early 1990s. In 2000, approximately 45 per cent fewer vessels were active in the halibut fishery than in 1991, the year the individual vessel quota regime was implemented. [\(219\)](#) This decline is especially impressive because the 2000 quota for the halibut fishery was 45 per cent greater than the 1991 quota. [\(220\)](#) In the Scotia-Fundy regime, the drop in the number of active vessels was even more dramatic, as the number of active vessels declined by 57 per cent between 1990,

the year before the quota program was implemented, and 1998. ⁽²²¹⁾ However, it must be emphasized that there were also significant declines in the global quotas for the fish populations covered by the Scotia-Fundy regime in the same period, because of declining fish populations, and that '[p]art of the increased concentration [in vessels] would be due to the changes in resource conditions.' ⁽²²²⁾ Still, the reduction in the number of vessels in the halibut fishery, in particular, would seem to suggest that individual quotas have increased the efficiency of commercial fishing, compared with command-and-control regulation.

V Ontario's recent interest in pollution markets

Given the regulatory program devised in the mid-1980s to reduce acid deposition, why is Ontario now introducing comprehensive emissions trading for sulphur dioxide and nitrogen oxides? Just as it may be tempting to attribute Canada's slow progress in introducing emissions trading to culture, so Ontario's recent interest in markets might be attributed, at first glance, to a shift in the dominant culture. In particular, it might be argued that Ontario is now turning to emissions trading because its current Conservative government is more ideologically disposed than its predecessors to rely on market mechanisms to regulate pollution. ⁽²²³⁾

However, in this part, I argue that Ontario's recent interest in pollution markets might also be explained, at least partly, in cost-based terms. I point to two factors that would seem to have bolstered the normative economic case for markets compared with the mid-1980s. The first is the establishment of a second round of sulphur dioxide reduction targets for electricity sources, as well as the first stringent cap on emissions of nitrogen oxides from these sources. The new caps on SO_2 and NO_x emissions would seem to increase the magnitude of the cost savings expected from comprehensive emissions trading compared with the mid-1980s and, accordingly, the case for implementing markets.

The second factor strengthening the case for markets is the greater difficulty, compared with the mid-1980s, of informally negotiating a cost-sensitive regulatory regime that would partially replicate the benefits of trading. This difficulty arises in part because Ontario is now targeting emissions of NO_x and SO_2 , not mainly SO_2 , as in the mid-1980s. The sources of NO_x are more numerous than the sources of SO_2 , and, accordingly, efficiently reducing NO_x emissions requires promoting reductions at a larger number of sources than is necessary to efficiently curtail SO_2 emissions. Moreover, the provincial policy of promoting competition in the electricity sector also now makes it more difficult to conceive of negotiating a regulatory framework *ex ante*. This is because the competitive market for electricity generation, which is expected to emerge through the transfer of significant components of Ontario Power Generation's existing generating capacity and through new entrants, is likely to increase the number of corporate sources of sulphur dioxide and nitrogen oxides, although perhaps not the number of major physical sources, provided natural gas remains the fuel of choice for new generating capacity.

I begin by discussing Ontario's new trading regime for sulphur dioxide and nitrogen oxides. I then suggest why there may now be a stronger case, from a cost-reduction perspective, for implementing comprehensive, inter-firm trading than there was in the mid-1980s.

a. Ontario's emissions trading regime

Ontario began phasing in markets for sulphur dioxide and nitrogen oxides early in 2002. ⁽²²⁴⁾ The markets Ontario is introducing are hybrid pollution markets combining elements of classic *allowance* trading programs, such as the US acid rain program, and *emission reduction credit* regimes, such as the Environmental Protection Agency (EPA)'s original emissions trading program. ⁽²²⁵⁾ Initially, only the electricity sector is subject to an aggregate cap on emissions of

sulphur dioxide and nitrogen oxides under Ontario's regime. In addition, at the outset, only the province's main fossil fuel-fired electricity generating sources, currently owned by Ontario Power Generation, are allocated *allowances* for free, adding up to the SO_2 and NO_x caps. [\(226\)](#) However, the government has signalled that caps may be established for other sectors in the future and that sources from sectors that are subsequently capped will become covered sources under the regime. [\(227\)](#)

Ontario's emissions trading regime incorporates elements of an emission reduction credit program by not restricting capped electricity sources, aiming to increase their emissions above their allowances, to purchasing additional allowances from other electricity sources in Ontario. Covered electricity sources are also able to purchase emission reduction *credits* from non-electricity sources that reduce their emission rates below a baseline level. [\(228\)](#) These credit-selling sources must be located in Ontario or in one of thirteen enumerated us jurisdictions within Ontario's airshed; [\(229\)](#) but they may include non-electricity sources inside Ontario and emitters from any sector within the enumerated us jurisdictions. [\(230\)](#) An important impetus for allowing the electricity sources to purchase credits from other Ontario, as well as us, sources would seem to be to expand the potential for cost savings by stimulating reductions at sources with lower abatement costs. [\(231\)](#)

Perhaps the most heavily criticized aspect of Ontario's trading regime concerns the effects of a sale of credits on the emission levels of the selling source. [\(232\)](#) Under the Ontario regime, the emission levels of sources selling credits to electricity generators will not be capped as of the date of the sale of credits. [\(233\)](#) Accordingly, the non-capped selling sources could potentially increase their emission levels (although not their emission rates) after selling credits, for example, in accordance with increases in production. [\(234\)](#) Thus there is a danger that overall provincial emissions of SO_2 and NO_x could actually rise under Ontario's regime, since (1) electricity sources could increase their emissions above their sectoral cap by purchasing credits from non-capped sources and (2) after selling credits based on reductions in emissions rates, these non-capped sources would then be able to increase their emission levels. [\(235\)](#)

b. cost-based case for trading

Why is Ontario now implementing pollution markets for SO_2 and NO_x ? As mentioned above, one possible explanation for the province's nascent interest in markets is its current Conservative government, which would seem to be ideologically inclined to rely on market mechanisms, such as emissions trading, to achieve public policy objectives. [\(236\)](#) But setting aside the possibility that a shift in the dominant political culture may be contributing to Ontario's implementation of pollution markets, there would also appear to be an economic explanation for Ontario's recent interest in markets. Two factors in particular suggest that the normative economic case for emissions trading is greater now than in the 1980s or the 1990s.

1. *New limits*

First, there may be a stronger case for trading from a cost-based perspective because Ontario is establishing pollution markets at the same time that it is adopting more stringent limits on emissions of NO_x and SO_2 . The principal motivations for the new NO_x limits are domestic commitments to reduce smog and Canada's obligations to reduce emissions of nitrogen oxides from fossil-fuel power plants in central and southern Ontario under the Ozone Annex to the 1991 Canada-United States Air Quality Agreement, signed in 2000. The new limits on SO_2 stem from the province's commitment to further reduce sulphur dioxide emissions as part of the

second major round of eastern Canadian reductions to address acid rain.⁽²³⁷⁾

Until recently, there was no specific cap on NO_x emissions from Ontario electricity sources. The acid rain control program initiated in the mid-1980s had capped Ontario Hydro's total acid gas (SO_2 and NO_x) emissions at 215 kilotonnes. But NO_x emissions were allowed to increase under this combined cap, provided there was a corresponding decline in SO_2 emissions.⁽²³⁸⁾ Notably, the new NO_x emission targets are significantly below existing levels of NO_x emissions from the electricity sector.⁽²³⁹⁾

The new caps on sulphur dioxide emissions from the electricity sector are more stringent than the cap phased in beginning in 1985.⁽²⁴⁰⁾ Yet, at first glance, the new SO_2 caps do not appear especially stringent compared with existing emission levels. The first cap to take effect will be 22 per cent above the actual level of electricity sector emissions of sulphur dioxide in 1999.⁽²⁴¹⁾ Furthermore, electricity sources will be required to reduce sulphur dioxide emissions below 1999 levels only in 2007, and the target that takes effect in that year will be only approximately 7 per cent below 1999 emission levels.⁽²⁴²⁾ Nonetheless, the new caps on sulphur dioxide emissions still may have some bite because electricity generation from fossil fuel-fired sources is expected to increase between now and 2007.⁽²⁴³⁾

It is significant that Ontario is implementing emissions trading at the same time that it is establishing new emission reduction targets, since the economic appeal of markets increases as the stringency of pollution reduction targets rises.⁽²⁴⁴⁾ As targets increase in stringency, the availability of 'fairly direct and inexpensive measures of pollution control'⁽²⁴⁵⁾ declines. Consequently, regulators find themselves operating on rising portions of marginal abatement cost functions.⁽²⁴⁶⁾ The result is that 'decisions to cut pollution ... further' become 'more costly.'⁽²⁴⁷⁾ As Cropper and Oates explain, 'this new setting for environmental policy places a much greater premium on the use of cost-effective regulatory devices, for the wastes associated with ... [command-and-control] policies will be much magnified.'⁽²⁴⁸⁾ Thus, Ontario's introduction of pollution markets might be considered an outgrowth of the increasing need to reduce pollution at the lowest possible cost, in light of the greater stringency of the province's pollution reduction objectives.

2. Difficulty of replicating gains from trading because of greater numbers

A second factor strengthening the economic case for emissions trading in 2002 is the greater difficulty of replicating through informal bargaining the expected gains from trading, compared with the 1980s. Specifically, it would now be more difficult to design an efficient regulatory framework *ex ante*, since the number of pollution sources of concern to regulators has increased, for three reasons.

First, the importance attached to reducing NO_x emissions, as demonstrated by the stringency of the NO_x reduction targets, strengthens the economic case for relying on emissions trading. This is because the sources of NO_x are more numerous than the sources of SO_2 were in the mid-1980s. Recall that in 1980, four corporate sources, operating eight large point sources, accounted for 85 per cent of Ontario SO_2 emissions.⁽²⁴⁹⁾ By comparison, the bulk of NO_x emissions currently come from numerous transportation sources (63.5 per cent). A range of industrial sources, including manufacturers, petroleum refiners, and iron and steel, cement and concrete, pulp and paper, and chemical industries, account for 17.2 per cent of emissions of nitrogen oxides. Electricity and residential or commercial sources account for 14.7 and 4.6 per

cent of provincial emissions, respectively. [\(250\)](#)

Taking as a given the province's objective of reducing no_x emissions from stationary sources, the almost equal contributions of electricity sources and industrial sources suggest that efficient abatement will require reductions from industrial sources as well as from fossil fuel-fired generators. In turn, the need to reduce no_x emissions from both industrial sources and electricity sources complicates the task of efficiently allocating no_x abatement *ex ante*, given that larger numbers of sources increase the burden associated with compiling information about relative abatement costs and strategies. [\(251\)](#) Accordingly, there would seem to be a stronger economic justification for no_x trading, although perhaps for an allowance, rather than a credit, regime. [\(252\)](#)

Second, a factor that would complicate efforts to replicate the gains from sulphur dioxide trading, in particular, is the smaller proportion of total Ontario sulphur dioxide emissions now coming from the major sources compared with the early 1980s. As mentioned above, in 1980, the four major corporate sources accounted for 85 per cent of Ontario's sulphur dioxide emissions. In 1999, in contrast, the three remaining corporate sources were responsible for slightly less than 67 per cent of total provincial emissions. [\(253\)](#) The smaller proportion of emissions emanating from the major sources strengthens the economic case for accessing reductions at smaller sources, which may have lower relative abatement costs, partly because these sources have been less tightly controlled than the major sources. But, again, larger numbers of sources increase the information burden on regulators and make it more difficult to devise an efficient regulatory regime in the absence of comprehensive trading. [\(254\)](#)

Finally, and perhaps most importantly, it may now be more difficult to efficiently reduce no_x and so_2 emissions in Ontario without comprehensive pollution markets because the provincial government is aiming to end Ontario Power Generation's virtual monopoly on electricity generation by encouraging new entrants and through the sale or lease of the corporation's existing fossil fuel-fired plants. [\(255\)](#) With the expectation that Ontario Power Generation - currently the second largest single source of so_2 and the principal electricity source of no_x - will be significantly downsized and will be joined by new competitors, it is no longer as feasible as it was in the 1980s to negotiate *ex ante* a cost-sensitive allocation of new air pollution reduction targets. Since the identity and the business strategies of the new entrants and the potential purchasers of Ontario Power Generation's existing assets remain largely unknown, it is difficult to gather reliable abatement cost information about the new sources, let alone to consult them on allocating the new pollution control targets.

Indeed, by itself, the policy of promoting competition in the electricity sector would likely be a sufficient reason for introducing emissions trading, at least for the electricity sector, even without the introduction of more stringent targets. As discussed above, Ontario Power Generation currently engages in intra-firm trading of sulphur dioxide and nitrogen oxide emissions to meet the so_2 , and combined so_2 and no_x , limits imposed as part of the acid rain reduction program initiated in 1985. Presumably, the cost savings generated through this trading in achieving the 1985 limits would be lost if there was no mechanism for allowing inter-firm trading of emissions following the sale or lease of Ontario Power Generation's coal-fired plants. [\(256\)](#)

viConclusion

This article has taken issue with one common, and intuitively appealing, explanation for us leadership in implementing emissions trading: the cultural hypothesis that the greater and

faster us embrace of pollution markets is attributable to differences between countries in attitudes towards property rights and markets more generally. The article has challenged this cultural hypothesis through a case study that casts doubt on the notion that Canada has been slow to adopt pollution markets because of a culturally rooted aversion to markets. I have taken issue with this notion partly by pointing to the widespread use of mechanisms analogous to tradeable pollution rights to manage important Canadian commercial fisheries. In addition, I have offered an alternative, cost-based hypothesis for Canada's slow progress in implementing pollution markets and its more rapid embrace of individual fishing quotas. This cost-based hypothesis emphasizes the possibility of partially replicating, under the rubric of conventional regulation, the cost savings promised by markets, where the number of resource users is small and the regulatory process is relatively informal. Implicitly, the cost-based hypothesis suggests that in these circumstances, regulators may be under less pressure (for example, from interest groups such as polluters) to introduce market mechanisms to realize cost savings, at least until stringent controls are imposed on resource use.

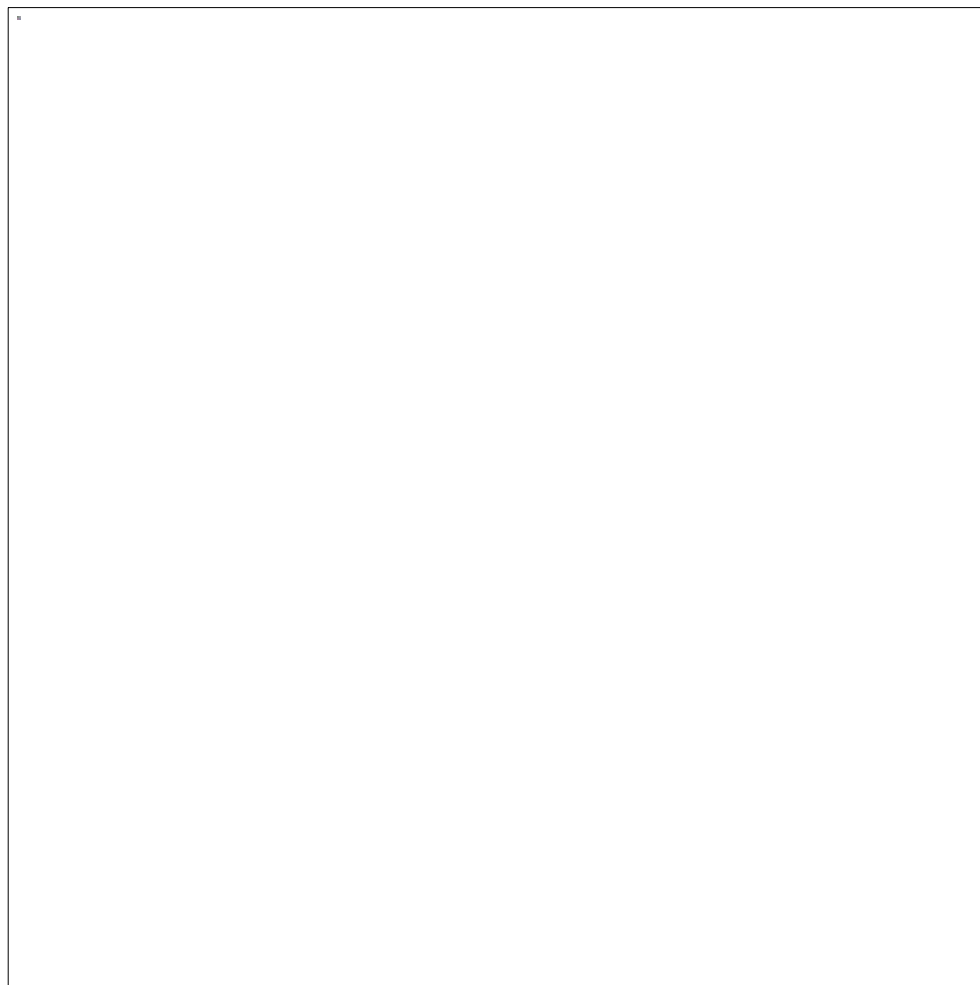
What are the implications of the Canadian experience for the broader discussion about why different jurisdictions have implemented pollution markets at different rates? One possibility is that greater us experimentation with emissions trading should be attributed not to culture but to the likelihood that American environmental regulation would have been especially inefficient in the absence of a comparatively more rapid shift toward emissions trading. In particular, us regulators may have been especially motivated to embrace pollution markets because of the large number of sources that us regulators often must control and the proceduralized and judicialized rule-making process through which they must work.⁽²⁵⁷⁾ At a minimum, the acid rain control program implemented in Canada in the 1980s provides indirect support for this proposition by illustrating the potential for developing cost-sensitive, particularized regulation, without introducing comprehensive trading, where the number of polluters is small and the regulatory process is relatively informal.

A second hypothesis raised by the Canadian experience is the possibility that other countries may have been slower than the United States to implement pollution markets because, like Canada, they may have been able until recently to informally bargain cost-sensitive regulatory frameworks, largely within the rubric of command-and-control. In this regard, it is noteworthy that a number of the European countries that have been slow to shift to emissions trading have a tradition of using contracts and covenants between regulators and regulated interests to achieve environmental objectives. The Netherlands represents a notable example of a jurisdiction with a tradition of contracting,⁽²⁵⁸⁾ and, indeed, there are indications that in the 1990s, that country relied on covenants between government and industry to regulate sulphur dioxide and nitrogen oxides, providing polluters with an element of flexibility.⁽²⁵⁹⁾ However, before concluding that any jurisdiction has been slow to shift to pollution markets because of an ability to partially mimic the benefits of trading through negotiation, it would be necessary to examine the terms of the regulatory framework bargained by regulators and polluters.⁽²⁶⁰⁾

Still a third possibility raised by my case study concerns the reasons why there now seems to be a greater interest in emissions trading in jurisdictions, in Europe and elsewhere, that have little experience with pollution markets, as well as in the United States itself.⁽²⁶¹⁾ In particular, in line with the cost-based hypothesis I set out for Canada's experience with pollution markets, it is possible that the emergence of emissions trading as an instrument of choice in environmental regulation may reflect the increasing stringency of pollution control targets. Emissions trading may now be growing in popularity because of the significant cost savings that it offers, as regulators contemplate both more stringent targets for pollutants that have been regulated for many years and regulating previously controlled sources for emissions only now recognized as harmful, such as greenhouse gases.⁽²⁶²⁾

Appendices

appendix a: trading in scotia-fundy mobile gear inshore groundfish individual quota program, 1999 fishing season



appendix b: major sources of sulphur dioxide emissions in eastern canada in 1980 and 1997

Corporation	Sector	Number of large point sources in 1980	% of eastern Canada emissions in 1980
Inco	smelting	2	27%
Noranda	smelting	3	17%
Ontario Hydro (now Ontario Power Generation)	electricity generation	5	10%
Hudson Bay Mining and Smelting	smelting	1	7%
Algoma	smelting	1	4%
New Brunswick Power	electricity generation	5	3%
Nova Scotia Power	electricity generation	4	3%
Falconbridge	smelting	1	3%

Total		22	74%*
-------	--	----	------

* This column does not add up to 75% due to rounding.

** This column does not add up to 69% due to rounding.

Sources: E-mail from Paul Quinn, Manager, Acid Rain Program, Environment Canada, to K. Wyman (29 March 2001); Canada, Environment Canada, *1997 Annual Report on the Federal-Provincial Agreements for the Eastern Canada Acid Rain Program* (1998); Ontario, Ministry of the Environment, *Coal-Fired Electricity Generation in Ontario* at 15, 18-23 (2001); Power Production Map, online: Ontario Power Generation <<http://www.opg.com/ops/map.asp>> (date accessed: 26 May 2002); telephone interview with Michael Hingston, Nova Scotia Department of Environment and Labour (30 March 2001); telephone interview with Denis Marquis, New Brunswick Department of Environment and Local Government (16 April 2001).

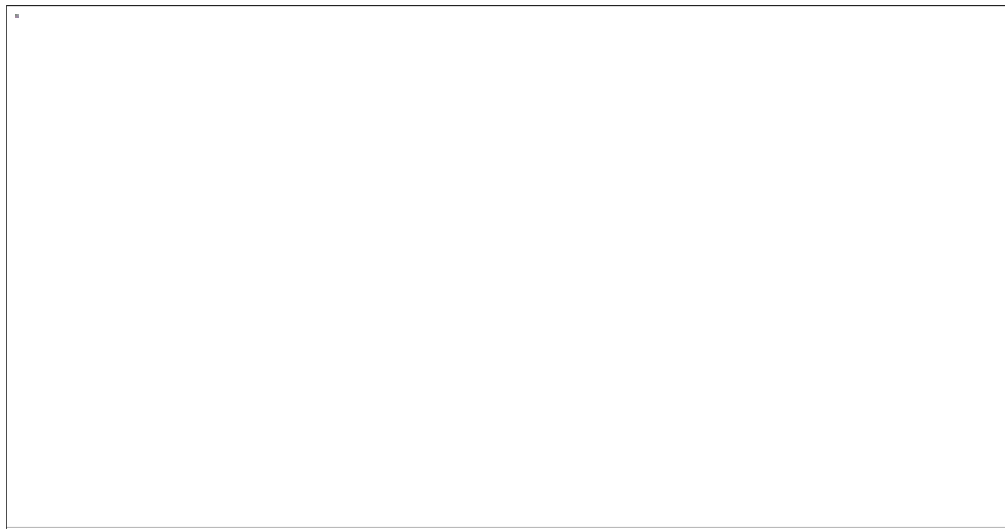
appendix c: major sources of sulphur dioxide emissions in ontario in 1980

Corporation	Number of large point sources in Ontario in 1980	% of Ontario emissions in 1980
Inco	1	46%
Ontario Hydro (now Ontario Power Generation)	5	23%
Algoma	1	9%
Falconbridge	1	7%
Total	8	85%

Sources: Canada, Environment Canada, *1997 Annual Report on the Federal-Provincial Agreements for the Eastern Canada Acid Rain Program* (1998); Ontario, Ministry of the Environment, *Coal-Fired Electricity Generation in Ontario* at 18-23 (2001); Power Production Map, online: Ontario Power Generation <<http://www.opg.com/ops/map.asp>> (date accessed: 26 May 2002).

appendix d: initial number of quota holders in 56 canadian

individual fishing quota programs





Notes

† This article benefited considerably from comments and suggestions from Richard Revesz. In addition, helpful comments were received from Alan Brudner, Jutta Brunnée, D. Leslie Burke, Bruce Chapman, Kevin Davis, Don Dewees, Jack Donnan, Jack Knetsch, Michael Trebilcock, and Stepan Wood, among others. Many useful suggestions also arose from presentations at the Canadian Law and Economics Association Conference in September 2001, Dalhousie Law School, New York University School of Law, Osgoode Hall Law School, and the University of Toronto Faculty of Law. Doug Macdonald generously provided information about acid rain control in the 1980s in eastern Canada. Angela James, Esther Oh, and Alex Van Kralingen provided excellent research assistance. The University of Toronto Faculty of Law and the Metcalf Foundation provided financial assistance.

* New York University School of Law.

1. See W.E. Oates, 'Innovations in Environmental Policy: From Research to Policy: The Case of Environmental Economics' (2000) *U.Ill.L.Rev.* 135 [hereinafter 'Innovation']; M.L. Cropper & W.E. Oates, 'Environmental Economics: A Survey' (1992) 30 *J.Econ.Lit.* 675 [hereinafter 'Environmental Economics']; R.H. Nelson, 'The Economics Profession and the Making of Public Policy' (1987) 25 *J.Econ.Lit.* 49 at 68-71. It should be noted that in the 1970s, economists generally advocated charges or fees for environmental policy, rather than marketable permits.

2. See, e.g., A.D. Ellerman et al., *Markets for Clean Air: The US Acid Rain Program* (New York: Cambridge University Press, 2000) at 3 [hereinafter *Markets for Clean Air*] ('More than thirty years ago, Dales (1968) demonstrated that, in theory, an emissions-trading system, in which rights to emit pollution are available in fixed and limited aggregate amount and are freely tradable, would induce rational firms to reduce pollution at the least possible cost'); L. Heinzerling, 'Selling Pollution, Forcing Democracy' (1995) 14 *Stan.Envtl.L.J.* 300 at 302 (referring to the 'somewhat obscure origins' of emissions trading 'in an essay by the Canadian economist J.H. Dales'); N.O. Keohane, R.L. Revesz, & R.N. Stavins, 'The Choice of Regulatory Instruments in Environmental Policy' (1998) 22 *Harv.Envtl.L.Rev.* 313 at 314 n. 3 [hereinafter 'Choice of Regulatory Instruments'] ('John Dales initially proposed a system of tradeable permits to control pollution'); J.E. Krier, 'The Tragedy of the Commons, Part Two' (1992) 15 *Harv.J.L.& Pub.Pol'y* 325 at 325-6 ('In 1968, the Canadian economist J.H. Dales popularized the ... technique of transferable pollution rights, which would ... internalize the costs of pollution to sources'); Oates, 'Innovation,' supra note 1 at 142 (discussing the significance of Dales's book). As Dales acknowledged, he was influenced by Ronald Coase. See J.H. Dales, *Pollution, Property and Prices: An Essay in Policy-Making and Economics* (Toronto: University of Toronto Press, 1968) at 110-11.

3. For recent overviews of US experience with emissions trading see National Center for Environmental Economics, *The United States Experience with Economic Incentives for Protecting the Environment* (Washington, DC: US Environmental Protection Agency, 2001) [hereinafter *US Experience*]; R.B. Stewart, 'A New Generation of Environmental Regulation?' (2001) 29 *Cap.U.L.Rev.* 21 at 104-10 [hereinafter 'A New Generation'].

4. Organisation for Economic Co-operation and Development, Environment Directorate, *Economic Instruments For Pollution Control and Natural Resource Management in OECD*

Countries: A Survey (Paris: OECD, 1999) at 36. See also R.N. Stavins, 'Experience with Market-Based Environmental Policy Instruments' (Resources for the Future, Discussion Paper 00-09, January 2000) [hereinafter 'Market-Based Policy Instruments'], which assessed US and international experience with emissions trading and other economic instruments.

It should be emphasized that while the United States has implemented more emissions trading programs than other countries, command-and-control remains the dominant approach in US environmental regulation. See Stewart, 'A New Generation,' supra note 3. But see E. Shogren & G. Polakovic, 'Bush Seeks to Curb Power Plant Emissions, Sets Climate Goals' *The Los Angeles Times* (15 February 2002) A18 (describing President George W. Bush's proposal to set new caps on sulphur dioxide, nitrogen oxides, and mercury and to rely on emissions trading to achieve the new targets); K.Q. Seelye, 'White House Rejected a Stricter E.P.A. Alternative to the President's Clear Skies Plan' *The New York Times* (28 April 2002) 26.

5. See generally J.B. Wiener, 'Something Borrowed for Something Blue: Legal Transplants and the Evolution of Global Environmental Law' (2001) 27 *Ecology L.Q.* 1295 at 1298-1300, 1351, 1357-8 (discussing the comparative law literature on legal borrowing across countries and noting that the sceptics of transnational legal borrowing suggest that transplantation may be impeded by differences in national culture, among other factors); O.G. Chase, 'Legal Processes and National Culture' (1997) 5 *Cardozo J.Int'l & Comp.L.* 1 (cultural differences represent formidable barriers to transplanting ideas from foreign legal systems); O. Kahn-Freund, 'On Uses and Misuses of Comparative Law' (1974) 37 *Mod.L.Rev.* 1 (identifying cultural differences as one of the factors that may inhibit the transplantation of legal institutions across countries).

6. See, e.g., F. Convery, 'Emissions Trading and Environmental Policy in Europe' (Pre-summit Conference, Knowledge and Learning for a Sustainable Society (Climate and Global Justice Session), Göteborg University, Sweden, 12-14 June 2001) at 11, online: <www.ucd.ie/~envinst/envstud/CATEP%20Webpage/publications/goteborg.pdf> (date accessed: 7 May 2002) [hereinafter 'Emissions Trading'] (describing Belgium, France, Germany, Italy, Spain, and Japan as 'laggards' in implementing emissions trading and suggesting that their lack of interest derives from a combination of factors, including a 'cultural ... sense that ... markets and [the] environment should not mix, ... intensified by the perception that ... "emissions trading is an American idea"'); G.B. Doern, 'Regulations and Market Approaches: The Essential Environmental Partnership' in G.B. Doern, ed., *Getting It Green: Case Studies in Canadian Environmental Regulation* (Toronto: C.D. Howe Institute, 1990) 1 at 22 [hereinafter 'Regulations and Market Approaches'] (Canada might be slower to implement pollution markets because '[i]deologically ... there is less ingrained appreciation of the value of markets in general in ... Canadian political culture' compared with the United States); S. Oberthür & H.E. Ott, *The Kyoto Protocol: International Climate Change Policy for the 21st Century* (Berlin, NY: Springer, 1999) at 190 ('Certain "cultural" differences also became visible [during the climate change negotiations] between a predominantly Anglo-American approach ... that was favourable towards trading and a certain mistrust of such concepts by continental European countries'); Stewart, 'A New Generation,' supra note 3 at 103 (suggesting that the United States has relied more on tradeable quotas than on taxes, and that Europe has relied more on taxes than tradeable quotas, because 'Europeans have tended to be more respectful of the power of the State and reluctant to see its responsibility for securing social objectives delegated to the market'). But see G. Kirchgässner & F. Schneider, 'On the Political Economy of Environmental Policy' (Department of Economics, University of St. Gallen, Discussion Paper No. 2001-20, November 2001). Kirchgässner and Schneider offer a public choice explanation from a European perspective for the limited use of market-based instruments such as emissions trading and taxes in environmental regulation that emphasizes opposition from polluters and bureaucrats to economic instruments. However, they do not explain why the United States has been more inclined to experiment with

emissions trading to date than other countries.

7. Until recently, Canadian governments had taken only limited steps to implement emissions trading. The federal environmental regulator, Environment Canada, had adopted a system of consumption allowances to help satisfy Canada's commitments under the Montreal Protocol with respect to ozone-depleting substances. See National Round Table on the Environment and the Economy, *Canada's Options for a Domestic Greenhouse Gas Emissions Trading Program* (Ottawa: National Round Table on the Environment and the Economy, 1999) at 94-5. In addition, beginning in the mid-1980s, three provinces, Ontario, New Brunswick, and Nova Scotia, had authorized their utilities to engage in intra-firm trading of sulphur dioxide emissions. See Canada, Senate, Standing Committee on Energy, the Environment and Natural Resources, 'The Energy Emissions Crisis: A Viable Alternative' (24 March 1993) at 18:44-5 (Chair: Hon. D. Hays) [hereinafter 'Energy Emissions Crisis']. See also text accompanying notes 200-8 *infra*. The limited intra-firm trading allowed in these provinces should be distinguished from the inter-firm and intra-firm trading permitted in a comprehensive pollution market. A third step that governments had taken in conjunction with industry was to establish two pilot emission reduction credit trading demonstration projects in the 1990s: the Pilot Emission Reduction Trading program (PERT) and the Greenhouse Gas Emission Reduction Trading program (GERT). See Clean Air Canada, online: Clean Air Canada <<http://www.cleanaircanada.org/home/html>> (date accessed: 14 May 2002); GERT <<http://www.gert.org/>> (date accessed: 14 May 2002).

Canada's limited use of emissions trading to date is complemented by a similar reluctance to rely on taxes and charges to regulate environmental quality. See R.S. Jutlah, 'Economic Instruments and Environmental Policy in Canada' (1999) 8 *J.Env.L.& Practice* 323 at 353-4 (appendix outlining economic instruments in use in Canada).

For criticisms of Canada's slow progress in implementing pollution markets see, *e.g.*, Doern, 'Regulations and Market Approaches,' *supra* note 6; D.N. Dewees, 'Regulation of Sulphur Dioxide' in G.B. Doern, ed., *Getting It Green: Case Studies in Canadian Environmental Regulation* (Toronto: C.D. Howe Institute, 1990) 129; Organisation for Economic Co-operation and Development, *Economic Surveys - Canada* (Paris: Organisation for Economic Co-operation and Development, 2000) [hereinafter *Economic Surveys*].

8. See EC, Proposal for a Directive of the European Parliament and of the Council Establishing a Scheme for Greenhouse Gas Emission Allowance Trading Within the Community and Amending Council Directive 96/61/EC COM(2001) 581 final, 2001/0245(COD). See also generally Convery, 'Emissions Trading,' *supra* note 6 (discussing the efforts of the European Commission to develop a proposal for a Community-wide CO₂ trading system, emissions trading schemes to address climate change in Denmark and the United Kingdom, and emissions trading regimes to address other environmental issues in the Netherlands (nitrogen oxides), the Czech and Slovak Republics (sulphur dioxide), and the United Kingdom (waste and water abstraction)); (2000) 9:3 *R.E.C.I.E.L.* (special issue on emissions trading).

9. See, *e.g.*, Canada, National Round Table on the Environment and the Economy, 'Emissions Trading: Other Countries' Experiences,' online: National Round Table on the Environment and the Economy <http://www.nrtee-trnee.ca/EmissionsTrading/en/overview_countries.htm> (last modified: 18 April 2002) (country-by-country review of progress on greenhouse gas emissions trading); B. Barton, 'Implementation of the Kyoto Protocol and the International Energy Industry - New Zealand' in P.D. Cameron & D. Zillman, eds., *Kyoto: From Principles to Practice* (The Hague: Kluwer Law International, 2001) 325 at 334-7; New Zealand Climate Change Programme, *Climate Change Working Paper: Domestic Emissions Trading* (Wellington: Department of Prime Minister and Cabinet, 2001); G. Triggs, 'The Kyoto Protocol and the

Energy Industry: Australia and the Asia-Pacific' in Cameron & Zillman, *ibid.*, 299 at 316-8; Australia, Parliament of Australia, House of Representatives, Standing Committee on Environment and Heritage, *Inquiry Into the Regulatory Arrangements for Trading in Greenhouse Gas Emissions - Interim Report* (1998), online: Parliament of Australia House of Representatives

<<http://www.aph.gov.au/house/committee/envIRON/greenhse/gasrpt/contents.htm>> (date accessed: 28 May 2002).

10. See Ontario, Ministry of the Environment, Environmental Registry Posting Number RA01E0020, 'Emissions Trading and NO_x and SO₂ Emission Limits For the Electricity Sector' (24 October 2001), online: Environmental Registry

<<http://204.40.253.254/envregistry/016576er.htm>> (last modified: 4 January 2002) [hereinafter Environmental Registry Posting Number RA01E0020] (announcing rules for pollution markets implemented by the province of Ontario for sulphur dioxide and nitrogen oxides in 2002); M. Mittelstaedt, 'Clean-Air Rules Too Lax, Firms Say' *The Globe and Mail* (23 August 2001) A8 (describing Ontario's plan as a proposal for 'Canada's first regulated emissions-trading system').

11. See, e.g., Canada, *A Discussion Paper on Canada's Contribution to Addressing Climate Change* (Ottawa: Government of Canada, May 2002), online: Government of Canada Climate Change Web Site

<http://www.climatechange.gc.ca/english/actions/what_are/canadascontribution/index.html> (date accessed: 15 May 2002) [hereinafter *Discussion Paper on Canada's Contribution*] (outlining four options for achieving Canada's commitments under the Kyoto Protocol, three of which include a domestic emissions trading regime); Canada, National Climate Change Process, Tradeable Permits Working Group, *Using Tradeable Emissions Permits To Help Achieve Domestic Greenhouse Gas Objectives Options Report* (Ottawa: Tradeable Permits Working Group, 2000) [hereinafter *Using Tradeable Emissions Permits*].

12. Doern, 'Regulations and Market Approaches,' *supra* note 6 at 22. Doern made this comment about the lack of appreciation of markets in passing, in the context of advocating greater use of economic instruments in environmental regulation. In this passage, Doern was predicting that Canada might be slow to adopt such instruments because of the lack of appreciation of markets he identified.

13. See C.M. Rose, 'Rethinking Environmental Controls: Management Strategies for Common Resources' [1991] Duke L.J. 1 at 3 [hereinafter 'Rethinking Environmental Controls'] (broadly defining 'environmental goods' as goods that 'don't belong to anybody in particular' and suggesting that they encompass fish as well as air); G. Hardin, 'The Tragedy of the Commons' (1968) 162 *Science* 1243 at 1245 (discussing ocean fishing and pollution as instances of the tragedy of the commons). As Hardin implies, pollution differs from fisheries in that pollution 'is not a question of taking something out of the commons, but of putting something in.' See *ibid.* at 1245.

Indeed, the depletion of fisheries might be considered the prototypical common pool problem. See G.D. Libecap, *Contracting for Property Rights* (Cambridge: Cambridge University Press, 1989) at 12 ('The classic articles outlining common pool problems ... by Gordon ... and Cheung. ... are built around open access fisheries'); Rose, 'Rethinking Environmental Controls,' *ibid.* at note 5 ('The idea of the tragedy of the commons may have had its beginnings with the study of fishing.');

S.V. Ciriacy-Wantrup & R.C. Bishop, "'Common Property" as a Concept in Natural Resources Policy' (1975) 15 *Nat.R.J.* 713 at 722 ('the "theory of common property resources" traces its origins to the literature on fisheries economics').

14. D.L. Burke & G.L. Brander, 'Canadian Experience with Individual Transferable Quotas' in R.

Shotton, ed., *Use of Property Rights in Fisheries Management: Proceedings of the FishRights 99 Conference, Fremantle, Western Australia, 11-19 November 1999, Mini-course Lectures and Core Conference Presentations, FAO Fisheries Technical Paper 404/1* (Rome: Food and Agriculture Organization of the United Nations, 2000) 151 at 152 [hereinafter 'Canadian Experience'] ('There are now more than 40 ... [individual quota] programmes in Canada ... of various sorts, accounting for over half of the value of fish landings. Most quota-managed fisheries have moved to ... [individual quotas]. The major ... [non-individual quota] fisheries currently are Pacific salmon and Atlantic lobster, neither of which is managed by a Total Allowable Catch (TAC) or quotas.'). A cautionary note is in order with respect to the statement that fisheries representing over half of the value of Canadian fish landings are managed through rights-based programs resembling emissions trading. As I discuss below, while there is active trading of fishing quotas in Canada, Canadian rights-based programs often include restrictions on transferability.

15. Indeed, the widespread use of rights-based programs in Canadian fisheries is especially notable in light of the limited use of such programs in US fisheries. See note 25 *infra* (discussing the limited use of rights-based programs in US fisheries).

16. For discussion of public choice explanations for the choice of instrument in environmental regulation see, *e.g.*, D.N. Dewees, 'Instrument Choice in Environmental Policy' (1983) 9:2 *Econ.Inquiry* 53; R.W. Hahn, 'The Political Economy of Environmental Regulation: Towards a Unifying Framework' (1990) 65 *Pub.Choice* 21 at 21-2 [hereinafter 'Political Economy']; R.W. Hahn & A.M. McGartland, 'The Political Economy of Instrument Choice: An Examination of the U.S. Role in Implementing the Montreal Protocol' (1989) 83 *Nw.U.L.Rev.* 592 [hereinafter 'Political Economy of Instrument Choice']; Keohane et al., 'Choice of Regulatory Instruments,' *supra* note 2; T.W. Merrill, 'Innovations in Environmental Policy: Explaining Market Mechanisms' (2000) *U.Ill.L.Rev.* 275 [hereinafter 'Innovations in Environmental Policy']. See also D.A. Dana, 'Overcoming the Political Tragedy of the Commons: Lessons Learned from the Reauthorization of the Magnuson Act' (1997) 24 *Ecology L.Q.* 833 (using public choice theory to explain elements of fisheries regulation).

17. This article refers in passing to the role of concentrated regulated interests in shaping the choice of instrument. See, *e.g.*, text accompanying notes 200-1 *infra* (referring to the role of the government-owned utility in shaping the pollution control program implemented in Ontario in the 1980s to reduce acid rain); notes 62-5 *infra* and accompanying text; and note 171 *infra* (referring to the role of fishing interests in shaping the implementation of individual quota programs).

18. See note 10 *supra* (describing the pollution markets Ontario is establishing as the first regulated pollution markets implemented in Canada).

19. H. Demsetz, 'Toward a Theory of Property Rights' (1967) 57 *Am.Econ.Rev.* 347 at 350. For an account that illustrates the role of ideology in defining approaches to environmental resources, see W. Cronon, *Changes in the Land: Indians, Colonists, and the Ecology of New England* (New York: Hill and Wang, 1983). See also E.T. Freyfogle, 'Land Use and the Study of Early American History' (1985) 94 *Yale L.J.* 717 (reviewing *Changes in the Land*).

20. 'Rethinking Environmental Controls,' *supra* note 13 at 29-36. For example, Rose states (at 35) that 'the normative acceptability' of property rights approaches to environmental regulation 'needs to be addressed.' See also J. Dryzek, 'The Informal Logic of Institutional Design' in R.E. Goodin, ed., *The Theory of Institutional Design* (New York: Cambridge University Press, 1996) 103 at 104 ('No institution can operate without an associated and supportive discourse (or discourses)') and 110 ('Proposals for quasi-market incentive mechanisms in environmental policy do, then, draw upon and reinforce a particular discourse, and this does much to explain

their political fate. I am not sure of the best name for this discourse; 'economic rationalism' may capture it well enough'); R.E. Goodin, 'Selling Environmental Indulgences' (1994) 47 *Kyklos* 573; S. Kelman, *What Price Incentives? Economists and the Environment* (Boston: Auburn House, 1981).

21. For histories of proposals for individual fishing quotas see A.D. Scott, 'Conceptual Origins of Rights Based Fishing' in P.A. Neher, R. Arnason, & N. Mollett, eds., *Rights Based Fishing* (Dordrecht: Kluwer Academic Publishers, 1989) 11 [hereinafter 'Conceptual Origins']; H.N. Scheiber & C. Carr, 'The Limited Entry Concept and the Pre-history of the ITQ Movement in Fisheries Management' in G. Palsson & G. Petursdottir, eds., *Social Implications of Quota Systems in Fisheries* (Copenhagen: Nordic Council of Ministers, 1997) 235 [hereinafter 'Limited Entry Concept']; P.H. Pearse, 'Fishing Rights and Fishing Policy: The Development of Property Rights as Instruments of Fisheries Management' in R.M. Meyer et al., eds., *Fisheries Resource Utilization and Policy: Proceedings of the World Fisheries Congress, Theme 2* (Lebanon, VA: Science Publishers, 1996) 10 [hereinafter 'Fishing Rights'].

Carleton College (later Carleton University) professor H.S. Gordon helped to lay the groundwork for scholarly discussion of market-based approaches by characterizing overfishing as an economic problem arising from 'the common-property nature of the resources of the sea' and not just a biological issue of fish depletion. See H.S. Gordon, 'The Economic Theory of a Common-Property Resource: The Fishery' (1954) 62:2 *J.Pol.Econ.* 124 at 134; Scott, 'Conceptual Origins,' *ibid.* at 21. However, the concept of individual quotas formally emerged in academic circles only in the late 1960s or early 1970s. See Scheiber & Carr, 'Limited Entry Concept,' *ibid.* at 251; Scott, 'Conceptual Origins,' *ibid.* at 26 (citing F.T. Christy, 'Fisherman Quotas: A Tentative Suggestion for Domestic Management,' Occasional Paper Series, Law of the Sea Institute, University of Rhode Island (Kingston, RI: University of Rhode Island, 1973)).

22. See Canada, Department of Fisheries and Oceans Working Group, 'Changing Access to Canadian Fisheries: Taking Stock and Future Directions' (1990) at Annex C [unpublished, on file with author] (suggesting that Canadian experience with rights-based programs in commercial fisheries dates to the establishment in 1972 of the Lake Winnipeg regime, which did not originally permit transfers of quota alone). See also G.S. Gislason, 'From Social Thought to Economic Reality: The First 25 Years of the Lake Winnipeg IQ Management Program' in R. Shotton, ed., *Use of Property Rights in Fisheries Management: Proceedings of the FishRights99 Conference, Fremantle, Western Australia, 11-19 November 1999, Workshop Presentations, FAO Fisheries Technical Paper 404/2* (Rome: Food and Agriculture Organization of the United Nations, 2000) 118 at 118 [hereinafter 'Lake Winnipeg'] ('Individual quota (IQ) fisheries management was introduced on Lake Winnipeg in 1972 and became the first IQ fisheries programme in Canada').

I emphasize the use of individual quotas in federally and provincially regulated fisheries because of the tendency in Canada to assume that fisheries are solely within federal jurisdiction. Furthermore, the use of individual transferable quotas in provincially (as well as federally) regulated fisheries suggests that Canada's slow progress in turning to pollution markets should not be attributed solely to the greater provincial role in regulating pollution than in regulating fisheries. See note 125 *infra* (discussing provincial regulation of pollution).

23. In a paper published in 1989, two employees of the Department of Fisheries and Oceans referred to the 'slow development of rights based fishing in Canada.' See C.A. Fraser & J.B. Jones, 'Enterprise Allocations: The Atlantic Canadian Experience' in P.A. Neher et al., eds., *Rights Based Fishing* (Dordrecht: Kluwer Academic Publishers, 1989) 267 at 268 [hereinafter 'Enterprise Allocations'].

24. Ellerman et al., *Markets for Clean Air*, *supra* note 2 at 4 (emissions trading 'has gone from

being a pariah among [US] policymakers to being a star - everybody's favorite way to deal with pollution problems'). See also C.R. Sunstein, 'Is Cost-Benefit Analysis for Everyone?' (2001) 53 Admin.L.Rev. 299 at 299 ('in the 1990s ... a consensus developed ... that ... regulation via economic incentives, such as emissions trading systems, should replace regulation via national command-and-control').

25. Only four rights-based programs have been implemented in US fisheries under federal jurisdiction, and a moratorium has prevented the creation of new individual quota programs in federal fisheries in the US since 1996. However, it should be noted that rights-based schemes have emerged in a number of fisheries 'through private cooperation,' as well as in state-managed fisheries. See A. Rieser, 'Prescriptions for the Commons: Environmental Scholarship and the Fishing Quotas Debate' (1999) 23 Harv.Envntl.L.Rev. 393 [hereinafter 'Prescriptions']; C. Hulse, 'Ban on Fishing Quotas Extended: The Silver Lining in the Decision for Gulf Fishermen Is that After 2002, the Ban May Be Lifted Quickly' *The Sarasota Herald-Tribune* (16 December 2000); B.J. McCay et al., 'Individual Transferable Quotas (ITQs) in Canadian and U.S. Fisheries' (1995) 28 Ocean & Coastal Man. 85 at 87 [hereinafter 'Individual Transferable Quotas'] (referring to other approximations of ITQs); T.L. Anderson & D.R. Leal, 'Fishing for Property Rights to Fish' in R.E. Meiners & B. Yandle, eds., *Taking the Environment Seriously* (Lanham, MD: Rowman & Littlefield, 1993) 161 at 165-7, 169-80 (describing examples of private rights in fisheries that emerged 'without government' and of individual transferable quota schemes implemented by fisheries regulators).

26. See C. Rose, 'Expanding the Choices for the Global Commons: Comparing Newfangled Tradable Allowance Schemes to Old-Fashioned Common Property Regimes' (1999) 10 Duke Envntl.L.& Pol'y F. 45 at 52-3 [hereinafter 'Expanding the Choices']; Rieser, 'Prescriptions,' supra note 25 at 410 ('The ITQ is in many ways similar to the emission reduction credits created under the 1990 Clean Air Act amendments, or the transferable development rights used in some states to conserve agricultural or ecologically sensitive land').

It should be noted that in the case of both pollution permit and individual quota regimes, governments have been reluctant to formally designate the rights thus allocated as property rights. The impetus for avoiding the property designation appears to be the same in the two cases: the possibility that rights may need to be withdrawn to protect the common pool resource and the desire to avoid paying compensation in the event that a withdrawal of rights becomes necessary. See, e.g., Burke & Brander, 'Canadian Experience,' supra note 14 at 159 (Canadian fishing quotas); A. Rieser, 'Property Rights and Ecosystem Management in U.S. Fisheries: Contracting for the Commons?' (1997) 24 Ecology L.Q. 813 at 821 [hereinafter 'Contracting for the Commons'] (in the United States, legislation states that individual fishing quotas do not create rights to fish 'to prevent IFQ [individual fishing quota] holders from developing "investment-based expectations" that could require the government to compensate them for the elimination of such rights'); 42 U.S.C.A. s. 7651b[f] (West, 1995) (allowance to emit sulphur dioxide does not constitute a property right); B. Yandle, 'Grasping for the Heavens: 3-D Property Rights and the Global Commons' (2000) 10 Duke Envntl.L.& Pol'y F. 13 at 17 n. 42 [hereinafter 'Grasping for the Heavens'] (allowances are defined by statute as not constituting property rights).

But see Gislason, 'Lake Winnipeg,' supra note 22 at 124 (in 1993 '[t]he Government of Manitoba ... recognized in legislation that "the allocation of an individual quota entitlement to a fisherman ... constitutes a property interest of the fisherman in a right to fish the specified quota." In addition, the government under stated policy could not cancel the [Lake Winnipeg Quota Entitlement] ... programme without giving five (5) years notice.'). See *The Fisheries Act*, R.S.M. 1987, c. F90, s. 34(1).

Notably, scholars are also reluctant to label the property rights arising under emissions trading

and individual quota programs as conventional private property, albeit for different reasons than governments. See Rose, 'Expanding the Choices,' *ibid.* at 51-2 (describing tradeable allowances for SO₂ and ocean fisheries as examples of 'hybrid property schemes' because tradeable environmental allowance systems 'are created and policed by government to a degree far surpassing conventional property rights'); McCay et al., 'Individual Transferable Quotas,' *supra* note 25 at 86 (describing individual transferable quotas as 'quasi-private property'); Yandle, 'Grasping for the Heavens,' *ibid.* at 16, 22, 24 ('most "property" rights markets today trade in regulatory property rather than private property').

27. In discussing 'paradigmatic,' or typical, pollution permit markets, I refer to US emissions trading regimes, such as the SO₂ trading program. In referring to paradigmatic pollution permit programs, I am borrowing from Nash and Revesz, who use the term 'paradigmatic regime.' See J.R. Nash & R.L. Revesz, 'Markets and Geography: Designing Marketable Permit Schemes to Control Local and Regional Pollutants' (2001) 28 *Ecology L.Q.* 569 at 575 n. 23 [hereinafter 'Markets and Geography'].

28. For discussions of the characteristics of property rights, including exclusivity, duration, security of tenure, and transferability see, *e.g.*, A.D. Scott, 'The ITQ as a Property Right: Where It Came from, How It Works, and Where It Is Going' in B.L. Crowley, ed., *Taking Ownership: Property Rights and Fishery Management on the Atlantic Coast* 31 at 37-8 (Halifax: Atlantic Institute for Market Studies, 1996) [hereinafter 'ITQ as a Property Right']. See also A.A. Alchian & H. Demsetz, 'Property Rights Paradigm' (1973) 33 *J.Econ.Hist.* 16 at 17 ('It is not *the* resource itself which is owned; it is a bundle, or a portion, of rights to *use* a resource that is owned').

In using the existence of individual fishing quotas to take issue with the cultural hypothesis for the slow introduction of pollution markets, this article implicitly rejects the significance of the ethical concerns that have been raised about tradeable pollution permits. Pollution markets have been described as commodifying (and thereby legitimizing) harmful activities. See, *e.g.*, M.J. Radin, 'What, If Anything, Is Wrong with Baby Selling?' (1995) *Pacific L.J.* 135 at 142 (referring to the sale of pollution permits as an instance of 'contested commodification,' since it 'makes something that we thought of as being a harm to ourselves and our environment and our atmosphere into a commodity'). These criticisms misconceive the implications of establishing pollution markets. Like individual fishing quotas, pollution markets represent an alternative to traditional command-and-control regulation for allocating access to the environment. Moreover, implementing a pollution market to allocate access may, in practice, reinforce the moral stigma attached to polluting. This is because under market approaches, polluters are required to pay for every unit of emissions, either by buying permits or by foregoing revenues from potential sales of allowances. In contrast, under command-and-control, polluters do not pay to pollute once they have complied with the applicable regulatory standards. Furthermore, the ethical concerns that have been raised about pollution markets ignore the possibilities that markets create for significantly reducing pollution. Since markets represent a lower-cost method of reducing pollution than conventional regulation, they allow regulators to implement more aggressive pollution control targets. See generally R.B. Stewart, 'Economic Incentives for Environmental Protection: Opportunities and Obstacles' in R.L. Revesz, P. Sands, & R.B. Stewart, *Environmental Law, the Economy and Sustainable Development* (Cambridge: Cambridge University Press, 2000) 171 at 197-200 (identifying and rejecting as unpersuasive criticisms on ethical grounds of economic incentive systems for environmental protection); J.B. Wiener, 'Global Environmental Regulation: Instrument Choice in Legal Context' (1999) 108 *Yale L.J.* 677 at 723-5 (rejecting the moral arguments against economic incentives).

29. See Rose, 'Rethinking Environmental Controls,' *supra* note 13 at 23 (arguing that individual

property represents the culmination of a series of management strategies and that all of the various control strategies discussed, including traditional command-and-control regulation, represent different kinds of property regimes). Emissions trading or quota regimes would represent the first appearance of property rights in the case of pollutants or fisheries that previously were unregulated.

30. See B.A. Ackerman & R.B. Stewart, 'Reforming Environmental Law: The Democratic Case for Market Incentives' (1988) 13 Colum.J.Envntl.L. 171 at 178 [hereinafter 'Reforming Environmental Law'] (describing the permit that a polluter receives under traditional command-and-control regulation and emphasizing that '[r]eformers propose to build upon, and do not abandon, this basic permit system'). See also R. Noll, 'The Political Foundations of Regulatory Policy' (1983) 139 J. Institutional & Theoretical Econ. 377 at 386 ('once a firm has had standards adopted for its emissions, it has a *de facto* property right in a valuable resource - the use of waterways and airsheds to dispose of waste').

31. See P.H. Pearse, 'From Open Access to Private Property: Recent Innovations in Fishing Rights as Instruments of Fishing Policy' (1992) 23 Ocean Dev.& Int'l L. 71 at 75 [hereinafter 'Open Access'] (discussing the advent of limited entry licensing in the fisheries, under which fishers are required to obtain a licence to exploit specific fisheries and the overall number of licences is limited): 'License limitation implied a fundamental change in the right to fish. Previously, fishermen's rights were no different from anyone else's, so they lacked an essential characteristic of property: the right to exclude others. With license limitation, fisheries remained common property in the sense that all fishermen holding licenses shared the right to fish the stocks, but others were now excluded.'

32. See Pearse, 'Fishing Rights,' supra note 21 at 16. See also Rieser, 'Prescriptions,' supra note 25 at 394 (referring to 'regulations designed to limit the amount of fish taken' as 'command-and-control regulations'); C.A. Tipton, 'Protecting Tomorrow's Harvest: Developing a National System of Individual Transferable Quotas to Conserve Ocean Resources' (1995) 14 Va.Envntl.L.J. 381 at 420 [hereinafter 'Protecting Tomorrow's Harvest'] (contrasting 'technology-limiting management schemes' with market-based systems for managing fisheries).

33. See Pearse, 'Fishing Rights,' supra note 21 at 17 (referring to individual fishing quotas as '[q]uantitatively specified rights'); P.H. Pearse, 'Property Rights and the Development of Natural Resource Policies in Canada' (1988) 14 Can.Publ.Policy 307 at 311 [hereinafter 'Property Rights'] ('More recently, fishing licenses in some Atlantic and freshwater fisheries have been changed from simply a right to fish to a right to take a specific quantity of fish').

In Canada, the property right conveyed by an individual quota often literally represents a further specification of the property right granted by a fishing licence because individual quotas tend to be 'catch limits ... specified in licences.' See Burke & Brander, 'Canadian Experience,' supra note 14 at 154. See also *Carpenter Fishing Corporation v. Canada* (1996), 123 F.T.R. 81 at 105 (T.D.), rev'd [1998] 2 F.C. 548 (C.A.) [hereinafter *Carpenter Fishing*]: 'The IVQ [individual vessel quota] program ... was put into effect as terms of a contract between the Minister of Fisheries and individual licence holders, the signing of which was a licensing condition. Each of the plaintiffs signed the contract in order to continue fishing their licences.'

34. See D.C. Esty, 'Revitalizing Environmental Federalism' (1996) 95 Mich.L.Rev. 570 at 582 n. 36 (referring to the SO₂ tradeable allowance system as an example of '[a] property rights regime ... for *emissions* into the atmosphere'). The italics emphasize that the rights allocated are not to the air itself but, rather, to emit pollutants into the air.

35. See, e.g., Nash & Revesz, 'Markets and Geography,' supra note 27 at 575 ('the

policymaker determines what aggregate level of emissions in a given year (or other time period) will be deemed acceptable and then subdivides this amount into a number of discrete emission permits, each of which authorize the holder to emit a fixed amount of the regulated pollutant' [footnote omitted]).

36. See R.Q. Grafton, D. Squires, & K.J. Fox, 'Private Property and Economic Efficiency: A Study of a Common-Pool Resource' (2000) 43 J.L.& Econ. 679 at 682-3 [hereinafter 'Study of a Common-Pool Resource'] (individual quotas 'provide a right over only the flow of the resource and not the stock of fish'); F.G. Peacock et al., 'Canadian Scallop Fishery Management: A Case History and Comparison of Property Rights vs. Competitive Approaches' in R. Shotton, ed., *Use of Property Rights in Fisheries Management: Proceedings of the FishRights99 Conference, Fremantle, Western Australia, 11-19 November 1999, Workshop Presentations, FAO Fisheries Technical Paper 404/2* (Rome: Food and Agriculture Organization of the United Nations, 2000) 239 at 244 [hereinafter 'Canadian Scallop Fishery'] (under an Enterprise Allocation system, in which quotas are allocated to enterprises rather than individual fishers or vessels, 'the enterprises hold valid licences to harvest, within the fishery, a specified quantity, in an organized and deliberate fashion without interference by the performance of others within the fleet'); Scott, 'ITQ as a Property Right,' supra note 28 at 46 (an individual transferable quota provides an exclusive right to an amount of the catch, although not a specific mass of fish or any particular surface or sea-floor space).

37. Anderson & Leal, 'Fishing for Property Rights to Fish,' supra note 25 at 179 (describing the benefits of expressing shares in terms of percentages and referring in passing to the difficulties encountered in individual transferable quota regimes in New Zealand in which shares were initially expressed in fixed quantities of fish). See also Pearse, 'Open Access,' supra note 31 at 79.

38. See Canada, Senate, Standing Committee on Fisheries, 'Privatization and Quota Licensing in Canada's Fisheries: Final Report of the Standing Senate Committee on Fisheries' (December 1998) (Chair: Hon. G.J. Comeau), online: Parliament of Canada <<http://www.parl.gc.ca/36/2/parlbus/commbus/senate/com-e/fish-e/rep-e/rep03dec98-e.htm>> (date accessed: 9 May 2002) [hereinafter 'Privatization and Quota Licensing'] (in Canada and elsewhere, initial allocations within a fleet are based largely on fishers' catch histories). See also Burke & Brander, 'Canadian Experience,' supra note 14 at 153 (describing 'historical catch (by vessel, by licence, or by fisherman) as one major factor for' allocating individual quotas, although noting that it may be 'tempered' by reference to other criteria such as the 'level of investment' as measured in dollars or vessel size). In practice, there may be a greater tendency than in the pollution context to award individual fishing quotas based on equal shares.

In the US sulphur dioxide trading program, allowances are allocated to existing power plants based on a formula tied to energy input, rather than on historical emissions. For an extended discussion of the allocation of permits in the program see P.L. Joskow & R. Schmalensee, 'The Political Economy of Market-Based Environmental Policy: The U.S. Acid Rain Program' (1998) 41 J.Law & Econ. 37.

39. I am following Rose in using the term 'tradable environmental allowance' to generically describe the property rights in emissions trading and individual quota regimes. See Rose, 'Expanding the Choices,' supra note 26 at 51.

40. See Rieser, 'Contracting for the Commons,' supra note 26 at 819 (referring to the 'bundle of sticks' metaphor).

41. See Nash & Revesz, 'Markets and Geography,' supra note 27 at 582 n. 57 and

accompanying text: '[P]ermits are generally traded in a single market, with no geographic restrictions' in the US sulphur dioxide trading program, the regional trading program for ozone precursors in the northeastern states, and the local trading regime in the Los Angeles area. However, the Los Angeles trading regime 'has a limited geographic restriction that generally prohibits sales of permits from inland areas to coastal areas.'

42. Although the US acid rain program contains a provision allowing industrial boilers that would not otherwise be subject to the program to voluntarily opt in, 'the voluntary industry-source program has ... been little used.' Ellerman et al., *Markets for Clean Air*, supra note 2 at 8 n. 9. See also *ibid.* at 199.

43. But see P.C. Thompson, L.E. Anderson, & D.E. Topolniski, 'Lake Winnipeg: Quota Entitlement Program' in Canada, Policy and Economics Branch, Department of Fisheries and Oceans, *Experience with Individual Quota and Enterprise Allocation (IQ/EA) Management in Canadian Fisheries, 1972-1994* (November 1994) Part B, 219 at 224 [unpublished, on file with author] [hereinafter 'Lake Winnipeg Quota Entitlement Program'], describing a composite species quota used in the Lake Winnipeg regime. In the Lake Winnipeg regime, there is one aggregate quota for whitefish, walleye, and sauger. See Gislason, 'Lake Winnipeg,' supra note 22 at 125.

44. However, there may be separate markets for regions within individual lakes. See E. Liuson, 'The Allocation of Commercial Fishing Rights within the Great Lakes' (June 1997), online: Environment Probe <<http://www.nextcity.com/EnvironmentProbe/pubs/ev538.htm>> (date accessed: 7 May 2002) [hereinafter 'Allocation of Fishing Rights']; E.R. Cowan & J. Paine, 'The Introduction of Individual Transferable Quotas to the Lake Erie Fishery' (Ottawa: Canadian Technical Report of Fisheries and Aquatic Sciences 2133, 1997).

45. See Department of Fisheries and Oceans, News Release NR-MAR-01-01, 'DFO Announces Optimistic Outlook for Scotia-Fundy Fishing Industry' (19 January 2001), which defines inshore or small boat fleet as vessels less than sixty-five feet.

46. Individual transferable quotas regulate inshore vessels between forty-five and sixty-five feet in length using fixed gear. See Canada, Department of Fisheries and Oceans, *Groundfish Integrated Fisheries Management Plan, Scotia-Fundy Fisheries Maritime Region, April 1, 2000-March 31, 2002* at s. 1.6.2, online: Department of Fisheries and Oceans <<http://www.mar.dfo-mpo.gc.ca/fisheries/res/imp/2000grndfish.htm>> (date accessed: 8 May 2002). The harvest by the large number of vessels under forty-five feet in length is regulated by allocating quotas to communities, which may opt for individual quotas. See F.G. Peacock & J. Hansen, 'Community Management in Groundfish: A New Approach to Property Rights' in R. Shotton, ed., *Use of Property Rights in Fisheries Management: Proceedings of the FishRights99 Conference, Fremantle, Western Australia, 11-19 November 1999, Workshop Presentations, FAO Fisheries Technical Paper 404/2* (Rome: Food and Agriculture Organization of the United Nations, 2000) 160 (discussing community quotas); Burke & Brander, 'Canadian Experience,' supra note 14 at 157 ('The division ... of inshore Scotian Shelf groundfish quotas into *community quotas* allowed relatively small groups of fishermen to form management boards to design their own fishing plans. Some boards opted for individual quotas').

47. See generally Rose, 'Expanding the Choices,' supra note 26 at 60-2.

48. For a discussion of the ecosystem approach to fisheries research and management see H.N. Scheiber, 'From Science to Law to Politics: An Historical View of the Ecosystem Idea and Its Effect on Resources Management' (1997) 24 *Ecology L.Q.* 631. Scheiber states (at 643 n. 34) that '[t]he necessity for multi-species management as a goal preferable to a research and management focus on single species is a staple in every discussion of fishery management and

reform and especially EM [ecosystem management] approaches today.'

See also Scott, 'ITQ as a Property Right,' supra note 28 at 83, noting that 'fishers in a mixed-species fishery may have one-species quotas that make them indifferent to the future size and health of secondary stocks. If so, one would wish to modify their indifference by giving them an economic interest in minor stocks or by penalizing them for harmful decisions.'

49. Burke & Brander, 'Canadian Experience,' supra note 14 at 152. See also McCay et al., 'Individual Transferable Quotas,' supra note 25 at 95 (describing '[q]uota management' as 'quite complex' in Canada); M. Gardner, 'The Enterprise Allocation System in the Offshore Groundfish Sector in Atlantic Canada' in P.A. Neher et al., eds., *Rights Based Fishing* (Dordrecht: Kluwer Academic Publishers, 1989) 293 at 295 [hereinafter 'Enterprise Allocation System'] (describing the subdivision of the TAC for each of the fifty stocks of the fourteen major commercial species in the Atlantic fishery between the offshore and inshore fleets, and within each of these fleets); Canada, Task Force on Incomes and Adjustment in the Atlantic Fishery, *Charting a New Course: Towards the Fishery of the Future, Report of the Task Force on Incomes and Adjustment in the Atlantic Fishery* (Ottawa: November 1993) at 16 (Chair: Richard Cashin) [hereinafter *Charting a New Course*] ('As confidence in the ability to predict the abundance of harvestable stocks grew in the 1980s, quotas were subdivided into thousands of allocations by area, vessel, gear type, and individual vessels').

50. Burke & Brander, 'Canadian Experience,' supra note 14 at 152. See also Gardner, 'Enterprise Allocation System,' supra note 49 at 318 (discussing the division of the inshore allocation in the Scotia-Fundy region in 1988 based on the length of vessels); Canada, Commission on Pacific Fisheries Policy, *Turning the Tide: A New Policy for Canada's Pacific Fisheries, The Commission on Pacific Fishery Policy: Final Report* (Vancouver: Minister of Supply and Services, 1982) at 82 (Commissioner: P.H. Pearse) [hereinafter *Turning the Tide*] ('fisheries policy, probably more than any other industrial policy, has been formulated with perceived social and economic needs of particular groups, communities and regions in mind. This can be explained by the historically poor economic environment of the fisheries, the economic and cultural dependence of certain ethnic and social groups on fishing and the identification of fishing with particular regions and communities with few alternative employment opportunities').

51. See Libecap, *Contracting for Property Rights*, supra note 13 at 22: 'Important differences across the parties in information regarding the resource, as well as in production cost, size, wealth, and political experience, will make the formation of winning political coalitions and consensus on the proposed assignment or adjustment of property rights more difficult.'

52. It is worth noting that fewer restrictions exist on trading individual quotas in New Zealand, which is widely regarded as a leader in introducing individual transferable quotas into fisheries management. See Pearse, 'Fishing Rights,' supra note 21 at 18; Pearse, 'Open Access,' supra note 31 at 77 ('New Zealand's quota-licensing system is undoubtedly the most adventurous in allowing unfettered market processes to allocate the catch, to establish the value of fishing rights, and to rationalize fishing fleets'). See also R.G. Newell, J.N. Sanchirico, & S. Kerr, *Fishing Quota Markets* (Resources For the Future, Working Paper, 19 March 2002) at 8-9 (discussing restrictions on transferability in New Zealand fishing quota programs).

53. See Nash & Revesz, 'Markets and Geography,' supra note 27 at 586, discussing the US sulphur dioxide trading regime.

54. Ellerman et al., *Markets for Clean Air*, supra note 2 at 167.

55. See R.L. Revesz, *Foundations of Environmental Law and Policy* (New York: Oxford

University Press, 1997) at 173: purchases by environmental groups 'are allowed under the acid rain provisions of the Clean Air Act, and the environmental law societies of several law schools have purchased permits at recent auctions.'

56. See, e.g., Liuson, 'Allocation of Fishing Rights,' supra note 44: in Great Lakes fisheries, 'commercial fishers are only authorized to buy, sell or lease quota to other commercial fishers within their quota area. Quota holders cannot sell their rights to those outside of the commercial fishery - say, sportfishing organizations that would like to buy, and then retire, the rights.'

57. In contrast, in New Zealand, individual quotas can be transferred 'to any New Zealander,' including non-fishers such as conservationists aiming 'to reduce catches,' subject to a concentration limit. See I.N. Clark, P.J. Major, & N. Mollett., 'The Development and Implementation of New Zealand's ITQ Management System' in P.A. Neher et al., eds., *Rights Based Fishing* (Dordrecht: Kluwer Academic Publishers, 1989) 117 at 134-5.

58. For example, the Natsource Web site describes the types of transaction that Natsource, a broker, services for sulphur dioxide allowances. See online: Natsource <<http://209.25.242.106/markets/index.asp?s=30>> (date accessed: 12 May 2002).

59. Temporary trades in fishing quotas are reminiscent of allowance loans in the sulphur dioxide market. See *ibid.*: in an allowance loan, 'one Party loans allowances (usually current vintage year) to another Party for a period of 1-5 years. An example of this type of transaction would be if one Party transferred 50,000 vintage year 2000 allowances on June 1, 2000, and received 52,000 vintage year 2002 allowances on June 1, the additional 2,000 being supplied by the borrower as loan interest.' See also Liuson, 'Allocation of Fishing Rights,' supra note 44 (comparing the in-season transfer of quota to a lease).

But see Groundfish Trawl Special Industry Committee, 'Review of the Groundfish Trawl Individual Vessel Quota/Groundfish Development Authority Plan: Discussion Paper' (29 September 1999) at 11 [unpublished, on file with author] [hereinafter 'Groundfish Trawl IVQ'] (discussing a range of possible forms of transfers under the groundfish trawl individual vessel quota program implemented off the Pacific coast).

60. In a paper prepared in 1999, two officials from the Department of Fisheries and Oceans indicated that 'half' of the individual quota programs that they identified in Canada then allowed permanent transfers of quota alone, albeit with restrictions of the sort described elsewhere in this section. See Burke & Brander, 'Canadian Experience,' supra note 14 at 154. The authors also provided an indication of the prevalence of restrictions on the mechanisms of exchange of the form described above. They suggested that individual quota programs prohibiting the sale of quotas without the accompanying transfer of a fishing licence have been implemented '[o]ccasionally' and that, '[i]n many cases, the restriction has been removed after a couple of years.' Furthermore, Burke and Brander described allowing 'temporary transfers within the fishing year only' as '[a] common transitional move.' See *ibid.* at 154. See also Scott, 'ITQ as a Property Right,' supra note 28 at 50-51 (discussing 'why fishers want transferability').

It is possible to doubt whether individual quota programs that do not allow either permanent or temporary trading of quota alone should be analogized to emissions trading. But the analogy may still hold in the case of these programs if there are few barriers to transferring licences and if licences are exchanged to consolidate fishing effort.

61. See generally Ellerman et al., *Markets for Clean Air*, supra note 2 at 167-8, discussing 'the lack of restrictions governing allowance trades' in the US sulphur dioxide trading program.

62. See Canada, Policy and Economics Branch, Department of Fisheries and Oceans, *Experience with Individual Quota and Enterprise Allocation (IQ/EA) Management in Canadian Fisheries, 1972-1994* (November 1994), Part A at 23 [hereinafter *Experience with IQ/EA Management*] ('Most restrictions [on transferability] have been introduced at industry's request, to control access to the fishery, to protect individual and community involvement, and to minimize job losses'). See also McCay et al., 'Individual Transferable Quotas,' supra note 25 at 107 (in establishing the individual quota regime for the Scotia-Fundy mobile gear sector for groundfish, regulators 'had to deal with conflicting demands for coastal community economic viability and employment on the one hand and fleet rationalization on the other').

See generally Libecap, *Contracting for Property Rights*, supra note 13 at 6 (distributional conflicts and efforts to address them can block institutional change or shape the agreements that are reached).

63. See Burke & Brander, 'Canadian Experience,' supra note 14 at 153 ('There continues to be a fear that independent fishers will be swallowed up by "corporate interests" in a transferable system'). See also Scott, 'ITQ as a Property Right,' supra note 28 at 55-8 (discussing concerns that allowing trading of fishing quotas will lead to takeovers of the harvesting sector by large companies, especially vertically integrated fish-buying firms).

64. Thompson et al., 'Lake Winnipeg Quota Entitlement Program,' supra note 43, Part B at 228 (more remote communities around Lake Winnipeg have more conservative 'limits on the number of quotas that can be held by an individual' compared with 'more developed communities,' which 'are adopting more liberal concentration rules in the interest of commercial viability').

65. Scott, 'ITQ as a Property Right,' supra note 28 at 58. See *ibid.* at 54-5, discussing concerns about allowing transferability for communities and fishing as a way of life.

Professor Kevin Davis has suggested to me that the restrictions on transferability in Canadian individual fishing quota programs may reflect a cultural aversion to wide-open trading. I agree that this is one possible interpretation of these restrictions. However, I tend to prefer another, public choice explanation for the existence of the restrictions. As suggested above, the restrictions might be considered the price that regulators have had to pay to achieve sufficient support from fishing communities to implement individual quota programs. In this vein, the restrictions might be understood as compromises introduced at the request of fishers motivated by self-interest rather than by culture. In particular, small-scale owner-operators, as well as residents of isolated communities economically dependent on small-scale fishing, would seem to have strong interest-based motivations for resisting wide-open trading, which might lead to a greater concentration of fisheries in the hands of large-scale fishing enterprises.

66. I consider trading activity in the Scotia-Fundy inshore mobile gear groundfish program and in the Pacific halibut regime because these programs are among the most widely discussed of the Canadian individual quota programs. On the Scotia-Fundy regime see, e.g., McCay et al., 'Individual Transferable Quotas,' supra note 25; R. Apostle, B. McCay, & K.H. Mikalsen, 'The Political Construction of an IQ Management System: The Mobile Gear ITQ Experiment in the Scotia Fundy Region of Canada' in G. Palsson & G. Petursdottir, eds., *Social Implications of Quota Systems in Fisheries* (Copenhagen: Nordic Council of Ministers, 1997) 27; R. Apostle et al., *Community, State, and Market on the North Atlantic Rim: Challenges to Modernity in the Fisheries* (Toronto: University of Toronto Press, 1998) [hereinafter *Community, State, and Market*]; D.S.K. Liew, 'Measurement of Concentration in Canada's Scotia-Fundy Inshore Groundfish Fishery' in R. Shotton, ed., *Use of Property Rights in Fisheries Management: Proceedings of the FishRights99 Conference, Fremantle, Western Australia, 11-19 November 1999, Workshop Presentations, FAO Fisheries Technical Paper 404/2* (Rome: Food and

Agriculture Organization of the United Nations, 2000) 279 [hereinafter 'Measurement of Concentration']. On the Pacific halibut regime see, e.g., Grafton et al., 'Study of a Common-Pool Resource,' supra note 36; G.S. Gislason, 'Stronger Rights, Higher Fees, Greater Say: Linkages for the Pacific Halibut Fishery in Canada' in R. Shotton, ed., *Use of Property Rights in Fisheries Management: Proceedings of the FishRights99 Conference, Fremantle, Western Australia, 11-19 November 1999, Workshop Presentations, FAO Fisheries Technical Paper 404/2* (Rome: Food and Agriculture Organization of the United Nations, 2000) 383 [hereinafter 'Stronger Rights']; *Carpenter Fishing*, supra note 33.

I also have obtained trading statistics for the 1999 fishing season for programs with smaller numbers of initial quota holders, specifically the shrimp trawl regime in Scotia-Fundy (twenty-nine initial quota holders), the regime for herring seiners in Scotia-Fundy (forty-nine initial quota holders), the Scotia-Fundy groundfish fixed-gear regime (sixty-four initial quota holders), and the Bay of Fundy inshore scallop regime (ninety-nine initial quota holders). E-mail from G.L. Brander, Chief, Economic Analysis, Policy and Economics Branch, Department of Fisheries and Oceans Maritimes Region, to K. Wyman (9 April 2001) [hereinafter Brander I]. In addition, I have obtained trading statistics for the 1997, 1998, 1999, 2000, and 2001 fishing seasons for the groundfish trawl individual vessel quota regime on the Pacific coast (103 initial quota holders). E-mail from B. Ackerman, Groundfish Trawl Co-ordinator, Groundfish Management Unit, Department of Fisheries and Oceans Pacific Region, to K. Wyman (22 October 2001). The trading statistics I have acquired suggest that there is active trading of individual quotas within these regimes; the extent of trading varies among the regimes.

I have not attempted to obtain statistics from either the Ontario or the Manitoba governments about the extent of trading within the regimes supervised by these governments. This is because literature that I reviewed suggested that, as of 1994 at least, neither of these provincial governments had centrally maintained trading statistics for even the regimes within their jurisdiction with the largest numbers of initial quota holders, specifically the Lake Erie program in Ontario (248 initial participants) and the Lake Winnipeg program in Manitoba (746 initial quota holders). See P.C. Thompson, L.E. Anderson, & D.E. Topolniski, 'Lake Erie: The Fishery Modernization Plan' in Canada, Policy and Economics Branch, Department of Fisheries, *Experience with Individual Quota and Enterprise Allocation (IQ/EA) Management in Canadian Fisheries, 1972-1994* (November 1994) Part B, 207 at 213; Thompson et al., 'Lake Winnipeg Quota Entitlement Program,' supra note 43, Part B at 226.

67. R. Barbara, L. Brander, & D. Liew, 'Scotia-Fundy Inshore Mobile Gear Groundfish ITQ Program' in Canada, Policy and Economics Branch, Department of Fisheries, *Experience with Individual Quota and Enterprise Allocation (IQ/EA) Management in Canadian Fisheries, 1972-1994* (November 1994) Part B, 25 at 26 [hereinafter 'Scotia-Fundy Inshore Mobile Gear']; B. Turriss & C. Sporrer, 'Halibut IVQ Program,' *ibid.*, Part B, 75 at 75.

68. Barbara et al., *ibid.* at 26 (Scotia-Fundy program); Turriss & Sporrer, *ibid.* at 76 (halibut program).

69. See *Turning the Tide*, supra note 50 at 80 (identifying vessels, rather than persons, as the licensed factor in the halibut fishery).

70. Barbara et al., 'Scotia-Fundy Inshore Mobile Gear,' supra note 67 at 38.

71. *Ibid.*

72. Grafton et al., 'Study of a Common-Pool Resource,' supra note 36 at 687; e-mail from C. Eros, Acting Halibut and Sablefish Coordinator, Department of Fisheries and Oceans Pacific Region, to K. Wyman (11 April 2001) [hereinafter Eros I]. Vessels were not permitted to hold

more than a single halibut licence.

73. See Grafton et al., 'Study of A Common-Pool Resource,' supra note 36 at 687.

74. E-mail from C. Eros, Acting Halibut and Sablefish Coordinator, Department of Fisheries and Oceans Pacific Region, to K. Wyman (19 April 2001) [hereinafter Eros II].

75. Gislason, 'Stronger Rights,' supra note 66 at 385.

76. There is a grandfathering provision covering the twelve licence holders who fished more than 1 per cent between 1993 and 1998, when the concentration limit, although not expressed in percentage terms, effectively allowed a vessel to harvest up to 1.57 per cent of the TAC. Eros I, supra note 72.

77. Gislason, 'Stronger Rights,' supra note 66 at 385.

78. See Appendix A infra for a graph illustrating the percentage of the global quota traded in the nine fish populations open for harvesting in the Scotia-Fundy regime in 1999. Information about trading in the Scotia-Fundy regime was provided by G.L. Brander, Chief, Economic Analysis, Policy and Economics Branch, Department of Fisheries and Oceans Maritimes Region. See Brander I, supra note 66. I have compiled a more detailed table based on the information obtained from Mr Brander.

79. Brander I, supra note 66. Specifically, there were eight permanent transfers of percentage shares in cod in region 4VSW and seven transfers of share for cod in region 4VN (M-O).

80. Information on trading in the halibut individual vessel quota program was obtained from Archipelago Marine Research Ltd., '2000 Halibut IVQ Fishery Data Summary, March 15-November 15' (21 February 2001) [unpublished, on file with author] at Tables 1 and 8 [hereinafter Archipelago Marine Research], and from C. Eros, Acting Halibut and Sablefish Coordinator, Department of Fisheries and Oceans Pacific Region (Eros I, supra note 72; Eros II, supra note 74). I have compiled a more detailed table based on the information obtained from these sources.

81. See Department of Fisheries and Oceans, News Release NR-MAR-01-01, 'DFO Announces Optimistic Outlook for Scotia-Fundy Fishing Industry' (19 January 2001) ('Most Scotia-Fundy fishermen hold licences for more than one species giving them the ability to participate in different fisheries throughout the year, and allowing them to change their target species when resources are more available'); Peacock et al., 'Canadian Scallop Fishery,' supra note 36 at 239 ('many [inshore Bay of Fundy scallop fishers] are dual licence holders').

82. Turriss & Sporrer, 'Halibut IVQ Program,' supra note 67 at 76; Grafton et al., 'Study of a Common-Pool Resource,' supra note 36 at 684 and 688 (many halibut licence holders are actively engaged in other fisheries, including salmon, rockfish, and sablefish).

83. Pearse, 'Fishing Rights,' supra note 21 at 17.

84. Grafton et al., 'Study of a Common-Pool Resource,' supra note 36 at 688. See also Peacock et al., 'Canadian Scallop Fishery,' supra note 36 at 243 ('the consequence of small groundfish quotas has been a movement of the [Scotia-Fundy mobile gear] fleet into directed scallop fishing. Multiple groundfish quotas are transferred to a single boat allowing that boat to fish the quota economically, while the original owners of the quota free their boats up to fish scallop-only').

85. Groundfish Trawl Special Industry Committee, 'Groundfish Trawl IVQ,' supra note 59 at 7. See *ibid.* at 10 ('One-way transfers are being utilized as a pre-season tool (planning and organizing the years' fishing operation) and increasingly, as a day-to-day tool, to adapt and adjust to in-season situations as may arise'). See also Peacock et al., 'Canadian Scallop Fishery,' supra note 36 at 245: 'Fleet capacity is voluntarily adjusted by enterprises [in the offshore scallop enterprise allocation program] as necessary and ongoing reviews of catches and catch rates allow for in-season adjustments.'

86. For example, 'very small [post-fishing trip] trades ... are frequently used to cover accidental bycatches or over-runs when the fisher has insufficient quota.' Burke & Brander, 'Canadian Experience,' supra note 14 at 154. New Zealand fishing quota programs, similarly, are characterized by greater temporary than permanent trading. See Newell et al., *Fishing Quota Markets*, supra note 52 at 13-15.

87. See, e.g., E. Brubaker, 'Unnatural Disaster: How Politics Destroyed Canada's Atlantic Groundfisheries' in T. Anderson, ed., *Political Environmentalism* (Stanford, CA: Hoover Institution Press, 2000), online: Environment Probe <<http://www.environmentprobe.org/enviroprobe/pubs/ev551.htm>> (date accessed: 9 May 2002) [hereinafter 'Unnatural Disaster'] ('half' of Atlantic Canada's '1,300 fishing communities depend entirely on the fisheries for their existence'); McCay et al., 'Individual Transferable Quotas,' supra note 25 at 94 (noting that the fact that the inshore fishery in Nova Scotia and New Brunswick 'is based in numerous small, rural, fisheries-dependent ... communities.... has meant that employment and the landing of fish ... have mattered a great deal').

88. Telephone interview with G. Peacock, Director, Resource Management, Department of Fisheries and Oceans (26 April 2001). See also Department of Fisheries and Oceans, Aboriginal Fisheries, online: Department of Fisheries and Oceans <<http://www.mar.dfo-mpo.gc.ca/fisheries/native/e/home-e.htm>> (date accessed: 9 May 2002) (discussing departmental acquisitions of commercial licences, vessels, and gear packages for aboriginal communities).

89. See Ernst & Young Management Consultants, *Options for Environmental Protection and Management in Ontario: Report Prepared for Ontario Ministry of the Environment, Fiscal Planning and Economic Analysis Branch, and Ontario Ministry of Treasury and Economics, Taxation Policy Branch and Social Economics and Strategic Issues Branch* (Toronto: Queen's Printer of Ontario, 1992) at 8 [hereinafter *Options for Environmental Protection*] ('in contrast to the relatively more modest number of major point sources ... regulated for total SO₂ emissions, achieving improvements in particulates, volatile organic compounds, or greenhouse-effect gases such as CO₂ would require behavioral changes by nearly all segments of industry and households'). See also *Discussion Paper on Canada's Contribution*, supra note 11 at 23 and 31 (estimating the number of sources that might be covered under various options for establishing a Canadian trading regime for achieving the country's commitments under Kyoto).

90. Cropper & Oates, 'Environmental Economics,' supra note 1 at 686: 'The chief appeal of economic incentives as the regulatory device for achieving environmental standards is the large potential cost-savings that they promise' compared with command-and-control.

91. See Ackerman & Stewart, 'Reforming Environmental Law,' supra note 30.

92. Cropper & Oates, 'Environmental Economics,' supra note 1 at 686.

93. Keohane et al., 'Choice of Regulatory Instruments,' supra note 2 at n. 1.

94. See Revesz, *Foundations of Environmental Law and Policy*, supra note 55 at 171 (US federal environmental laws tend to embody emission performance standards rather than 'equipment or design standards' mandating the use of specific technologies). See also Keohane et al., 'Choice of Regulatory Instruments,' supra note 2 at n. 1: 'Performance standards could specify an absolute quantity of permissible emissions (that is, a given quantity of emissions per unit of time), *but more typically* these standards establish allowable emissions in proportional terms (that is, quantity of emissions per unit of product output or per unit of a particular input).' [emphasis added].

95. See Organisation for Economic Co-operation and Development, *Environmental Performance Reviews: Canada* (Paris: OECD, 1995) at 100 [hereinafter OECD III]: Canadian 'provinces largely rely on site-specific permits (rather than point-source emission standards).'

96. B. Swift, 'The Acid Rain Test' *The Environmental Forum* 14:3 (May/June 1997) 17 at 19.

97. Ackerman & Stewart, 'Reforming Environmental Law,' supra note 30 at 179.

98. Ibid. at 179 n. 17.

99. See also Cropper & Oates, 'Environmental Economics,' supra note 1 at 686: 'a system that puts a value on any discharges remaining after control (such as a system of fees or marketable permits) will provide a greater incentive to R&D efforts in control technology than will a regulation that specifies some given level of discharges.'

100. Tipton, 'Protecting Tomorrow's Harvest,' supra note 32 at 383.

101. Ibid. See also Anderson & Leal, 'Fishing for Property Rights to Fish,' supra note 25 at 162: 'In the race to capture rents (profits), expenditures by fishermen drive up total costs and drive down the marginal productivity of additional fishing effort.'

102. In addition to reducing excessive capital investments in the fishery, simply extending quantitative rights to a portion of the harvest also may extend the fishing season. Secure in the knowledge that they are entitled to a portion of the harvest, fishers may spread out the time over which they take their share of the harvest. Extending the fishing season may not only reduce the costs associated with extracting the resource but also increase the price obtained for fish by avoiding gluts and enabling fishers to market a higher-value, fresher product. See R.Q. Grafton, 'Individual Transferable Quotas and Canada's Atlantic Fisheries' in D.V. Gordon & G.R. Munro, eds., *Fisheries and Uncertainty: A Precautionary Approach to Resource Management* (Calgary: University of Calgary Press, 1996) 129 at 131 [hereinafter 'Canada's Atlantic Fisheries'].

103. Ibid.

104. See text accompanying notes 81-2 supra.

105. See Grafton, 'Canada's Atlantic Fisheries,' supra note 102 at 137: 'It is transferability of quota that allows fishers to retire labour and capital. Without the ability to sell quota to other fishers, less profitable fishers may choose to remain in the fishery preventing more profitable fishers from harvesting a greater share of the TAC.'

Furthermore, tradeable quotas also may provide an incentive to safeguard fish stocks, by encouraging fishers to restrict the total allowable catch in order to protect the stocks. Once fishers enjoy a right to a percentage of the harvest, they may be motivated to maximize the value of their rights by preserving, or improving, the condition of the underlying fishery.

Protecting the fish stock may increase the market value of the fisher's entitlement to a portion of the harvest in the event of a sale and increase the actual catch of the fisher while he or she holds the entitlement. See Tipton, 'Protecting Tomorrow's Harvest,' supra note 32 at 410-1 (fishermen with individual transferable quotas enjoy a strong and direct interest in the continued health of the species, since they will suffer a direct economic loss in the value of their property rights '[i]f stocks are not protected'); R. Repetto, *The Atlantic Sea Scallop Fishery in the U.S. and Canada: A Natural Experiment in Fisheries Management Regimes* (Discussion Paper, Yale School of Forestry & Environmental Studies, 15 April 2001) at 9 [hereinafter *Atlantic Sea Scallop Fishery*] ('the Canadian [offshore scallop] industry has opted for conservative overall quotas in the knowledge that each quota holder will proportionately capture the benefits of conservation through higher catch limits in subsequent years'). But see Rieser, 'Contracting for the Commons,' supra note 26 at 820, 822 (expressing scepticism about the argument that individual transferable quotas will promote stewardship of the resource on the grounds that individual transferable quotas merely constitute a usufructuary right); note 222 infra (noting that important fisheries collapsed in Atlantic Canada even though they were being managed using individual quotas).

106. See generally J. Krier & W.D. Montgomery, 'Resource Allocation, Information Cost and the Form of Government Regulation' (1973) 13 Nat.Res.J. 89 at 99 [hereinafter 'Resource Allocation'] (drawing on Demsetz's theory concerning the evolution of property rights and suggesting that marketable permits and taxes will be used increasingly as resources become more scarce, since government intervention will tend to evolve towards forms that will economize on the information costs associated with a more efficient allocation of resources); Rose, 'Rethinking Environmental Controls,' supra note 13 (describing four progressively more costly strategies for managing environmental resources and suggesting that, as a positive matter, more costly strategies are implemented as the pressure on resources increase, because the benefits justify the costs); Merrill, 'Innovations in Environmental Policy,' supra note 16 at 278-80 (discussing the relationship between Rose's framework for understanding the evolution of environmental policy and Demsetz's theory concerning the emergence of property rights, and describing Rose's theory for the evolution of regulatory instruments as a 'wealth-maximization theory').

107. See Rose, 'Rethinking Environmental Controls,' supra note 13 at 7-8: the choice of regulatory instrument becomes relevant once there is a 'consensus about the point at which we [would] ... feel uncomfortable with further depletion.'

108. See Cropper & Oates, 'Environmental Economics,' supra note 1 at 730, and text accompanying notes 244-8 infra. Similarly, in the natural resources context, Gary Libecap suggests that '[a]ll things being equal, the greater the size of the anticipated aggregate benefits of institutional change ..., the more likely new property rights will be sought and adopted.' *Contracting for Property Rights*, supra note 13 at 28.

109. I am borrowing this term from B.J. McCay, 'Foxes and Others in the Henhouse? Environmentalists and the Fishing Industry in the U.S. Regional Council System' in R.M. Meyer et al., eds., *Fisheries Resource Utilization and Policy: Proceedings of the World Fisheries Congress, Theme 2* (Lebanon, VA: Science Publishers, 1996) 380 at 381.

110. See R.G. Newell & R.N. Stavins, 'Cost Heterogeneity and the Potential Savings from Market-Based Policies' (Resources For the Future, Discussion Paper 00-10, 2 November 2000).

111. Cropper & Oates, 'Environmental Economics,' supra note 1 at 686.

112. Ackerman & Stewart, 'Reforming Environmental Law,' supra note 30 at 179.

113. A.D. Scott & P.A. Neher, eds., *The Public Regulation of Commercial Fisheries in Canada* (Ottawa: Economic Council of Canada, 1981) at 42 [hereinafter *Public Regulation of Commercial Fisheries*]: finely divisible rights 'will permit those best suited to acquire and hold ... rights - i.e., the most efficient fishermen - to obtain them through the market' [emphasis added].

114. Cropper & Oates, 'Environmental Economics,' supra note 1 at 686 ('The source of [the] ... large cost savings is the capacity of economic instruments to take advantage of the large differentials in abatement costs across polluters. The information problems confronting regulators under the more traditional [command-and-control] approaches are enormous - and they lead regulators to make only very rough and crude distinctions among sources'). See also Ackerman & Stewart, 'Reforming Environmental Law,' supra note 30 at 180 (referring to 'the information processing tasks that are presently overwhelming the federal and state bureaucracies'); Hahn & McGartland, 'Political Economy of Instrument Choice,' supra note 16 at 600 ('Because regulators have very limited information in setting production and consumption limits, command-and-control approaches are usually highly inefficient' [citation omitted]).

115. See generally D.P. Dupont, 'Limited Entry Fishing Programs: Theory and Canadian Practice' in D.V. Gordon & G.R. Munro, eds., *Fisheries and Uncertainty: A Precautionary Approach to Resource Management* (Calgary: University of Calgary Press, 1996) 107 at 109-10 [hereinafter 'Limited Entry Fishing'] ('When the government restricts the total harvest of a fishery via a TAC, but does not have perfect control over the effort employed to catch the fish, the presence of above average returns (rents) in the fishery encourages the entry of additional effort.... The theoretical solution is to limit directly the amount of effort directed at the fishery by permitting the minimum necessary effort needed to take the TAC. This is a limited entry or restricted access policy. In practice, regulators have had difficulty in implementing such a policy. The difficulty arises because of the divergence between the theoretical construct called fishing effort and the reality of the bundle of inputs that comprise effort').

116. See J. Wilen, 'Rent Generation in Limited Entry Fisheries' in P.A. Neher et al., eds., *Rights Based Fishing* (Dordrecht: Kluwer Academic Publishers, 1989) 249 at 251. In discussing the evolution of fishing capacity after the implementation of limited-entry licensing in the British Columbia salmon fishery, Wilen states that 'the British Columbia experience also immediately revealed a rapid erosion of simple effort controls as fishermen found ways to circumvent regulators by expanding the "free" dimensions of effort. In the British Columbia experience, the result was a series of regulation changes as managers "chased" fishing effort through several phases.'

117. See generally Dupont, 'Limited Entry Fishing,' supra note 115 at 121-2. See also *Turning the Tide*, supra note 50 at 83: Restricting inputs to control overcapacity 'has a fundamental weakness: when one or more inputs in the fishing process are restricted, the capacity of the fleet can continue to expand by adding other, unrestricted inputs. As a result, this technique has consistently failed to achieve the desired results. For example, in the Pacific salmon fishery, the initial restriction on the number of vessels led to their being replaced with larger vessels. Then, in an effort to control vessel size, restrictions on tonnage and length were added. These led to further investments in new gear and vessel improvements.'

118. Canada, Department of Fisheries and Oceans, *Report of the Scotia-Fundy Groundfish Task Force* (Ottawa: Department of Fisheries and Oceans, 1989) at 12 (Chair: J.-E. Haché) [hereinafter *Scotia-Fundy Groundfish Task Force*].

119. *Turning the Tide*, supra note 50 at 83. See also Pearse, 'ITQ as a Property Right,' supra note 28 at 44 ('It is usually impossible for the government to fix the number, size, gear, power, crews, and other dimensions of the fleet for all time. It can attempt to regulate every

dimension, but it can hardly prevent total racing and storage capacity from creeping upwards.... Inspections and monitoring help, but each owner has more ways to upgrade his vessel's racing and carrying capacities than each inspector has to hold them down'); D. Squires, J. Kirkley, & C.A. Tisdell, 'Individual Transferable Quotas as a Fisheries Management Tool' (1995) 3(2) *Rev. Fisheries Sci.* 141 at 142 ('it is notoriously difficult to define a unique relationship between a vessel license and the resulting harvesting capacity in most circumstances inasmuch as a vessel license gives fishers an incentive to increase the use of economic inputs not specified by the license').

120. *Scotia-Fundy Groundfish Task Force*, supra note 118 at 12; R.Q. Grafton, 'Individual Transferable Quotas and the Groundfish Fisheries of Atlantic Canada' (prepared for the Task Force on Incomes and Adjustment in the Atlantic Fishery, January 1993) at 4-5 [unpublished] [hereinafter 'Groundfish Fisheries'] ('input controls often reduce the technical efficiency of the fleet').

121. See Canada, Task Force on Atlantic Fisheries, *Navigating Troubled Waters: A New Policy for the Atlantic Fisheries, Highlights and Recommendations, Report of the Task Force on Atlantic Fisheries* (1982) at 78 (Chair: M.J.L. Kirby) [hereinafter *Navigating Troubled Waters*] ('regulating the size and number of fishing boats to keep the race "fair" and to cut down on over-investment.... stifles improved technical efficiency, because a fisherman cannot change the size of his boat or take automatic advantage of improvements in gear because they are not permitted by the regulations'); *Turning the Tide*, supra note 50 at 83.

122. These other assumptions include the likelihood that a competitive market will emerge and that no participant will be able to exert market power either in the permit market or, especially, in a product market. See L.G. Anderson, 'A Note on Market Power in ITQ Fisheries' (1991) 21 *J. Env. Econ. & Management* 291; G.T. Svendsen, *Public Choice and Environmental Regulation: Tradable Permit Systems in the United States and CO₂ Taxation in Europe* (Northampton, MA: Edward Elgar, 1998) at 56-7. In addition, there is an assumption that the environmental resource being traded is fungible as to time and place. See J. Salzman & J.B. Ruhl, 'Currencies and the Commodification of Environmental Law' (2000) 53 *Stan.L.Rev.* 607.

123. It is worth briefly noting the background to the sulphur dioxide reduction program inaugurated in 1985. For a comprehensive account see D.C. Macdonald, *Policy Communities and Allocation of Internalized Cost: Negotiation of the Ontario Acid Rain Program, 1982-1985* (Ph.D. Dissertation, York University 1997) [unpublished] [hereinafter *Policy Communities*].

Beginning in the late 1960s and the 1970s, three of the major Canadian emitters of sulphur dioxide - Inco, Falconbridge, and Algoma - had been required to reduce their emissions to address local air pollution problems. In addition, Ontario Hydro also began reducing its sulphur dioxide emissions in 1970s, before a control order was imposed on the company. See Dewees, 'Regulation of Sulphur Dioxide,' supra note 7 at 140.

In the early 1980s, Canadian jurisdictions became concerned with reducing SO₂ to control acid rain, in response to pressures from domestic environmental interests and the need to bolster Canada's case for US SO₂ emission reductions. As Macdonald explains (at 140), '[a]pproximately half of the sulphate deposition received in Canada ... was believed to originate in the United States and for that reason the Canadian policy objective [in the early 1980s] ... was to influence the US process in such a way as [to] reduce emissions in that country.'

In 1980, Ontario required Inco to reduce its emissions to 645 kilotonnes per year effective

1982, and in 1981 the province required Ontario Hydro to reduce its emissions to 260 kilotonnes per year effective 1990. Quebec also announced reductions in sulphur dioxide emissions from Noranda before 1985. See Memorandum from G. Endicott, Abatement Strategy Coordinator, Acid Precipitation in Ontario Study (A.P.I.O.S.), Ontario Ministry of the Environment, to Dr. D. Balsillie, Director, Air Resources Branch, Ontario Ministry of the Environment (24 February 1984) at Table 1B [unpublished, on file with author] [hereinafter Endicott Memorandum] (identifying announced SO₂ reductions from 1980 base case); Macdonald, *ibid.* at 127 (SO₂ controls imposed on Ontario sources).

In February 1982, federal and provincial environment ministers from eastern Canada agreed to reduce sulphur dioxide emissions by 50 per cent by comparison with 1980 levels if the United States committed to a 50 per cent reduction, but the ministers did not allocate the 50 per cent commitment among the provinces. In March 1984, the federal and provincial environment ministers agreed to a 50 per cent unilateral reduction from 1980 levels, in the absence of a similar reduction commitment from the United States. Again, however, the commitment was made without allocating the 50 per cent reduction among the provinces. Finally, in February 1985, the federal and provincial ministers agreed to an allocation of the 50 per cent reduction commitment, although 319 kilotonnes were left unapportioned. In December 1985, Ontario, by then under a new government committed to more aggressive reductions in sulphur dioxide emissions, announced a control program premised on a more stringent control target than the province had assumed in February. In referring to the program inaugurated in 1985, I am referring to the reduction initiative announced in February 1985, as adjusted by the program announced by Ontario in December 1985. See Ontario, Ministry of the Environment, *Countdown Acid Rain: Ontario's Acid Gas Control Program for 1986-1994* (1985) at 5 [hereinafter *Countdown Acid Rain*] (discussing the February 1985 announcement by the federal, and the seven eastern provincial, environmental ministers of the inter-provincial allocation of the 50 per cent global reduction target to which the ministers had agreed in 1984).

Only the seven Canadian provinces east of the Manitoba/Saskatchewan border (Manitoba, Ontario, Quebec, New Brunswick, Nova Scotia, Newfoundland, and Prince Edward Island) were included in the Canadian acid rain control program because it was only in these provinces that acid deposition was considered to have harmful effects.

Throughout the early 1980s, as the discussion above implies, federal and provincial regulatory authorities 'agreed that 1980 would be the base-case or bench-mark year for emissions against which all reductions would be measured.' J. Donnan et al., 'Results and Performance of the Ontario Countdown Acid Rain Program: A Retrospective Study' (Canadian Resource and Environmental Economics Study Group 10th Annual Conference, Guelph, Ontario, 13-15 October 2000) at 15 [hereinafter 'Results and Performance'] [unpublished draft, on file with author]. However, throughout the period between 1980 and 1985, 1980 emission levels were revised for several reasons, including a desire to reduce the stringency of the Canadian 50 per cent reduction commitment by increasing the base case numbers. See *ibid.* at 16-7. Ultimately, the 50 per cent reduction target apportioned in 1985 would seem to have represented a reduction from a combination of actual emissions and legally allowable emission levels in 1980. See Macdonald, *ibid.* at 120-1, 123-4; Endicott Memorandum, *ibid.* at Table 1A (base case sulphur dioxide emissions for acid rain abatement programs); *Countdown Acid Rain*, *ibid.* at 5 (identifying the 1980 base case on which the 50 per cent reduction commitment was apportioned in February 1985). Notably, federal government documents from the 1990s describe the 'Eastern Canada Acid Rain Program' as having 'established a cap on SO₂ emissions in the seven easternmost provinces of 2.3 million tonnes, for a 40% reduction from *actual* 1980 levels.' Canada, Environment Canada, *1997 Annual Report on the Federal-Provincial Agreements for the Eastern Canada Acid Rain Program* (1998) at 1 [emphasis added]

[hereinafter *1997 Annual Report*]. For greater clarity, this article draws on 1980 emission levels set out in Environment Canada's *1997 Annual Report*, except as otherwise noted, because the *1997 Annual Report* contains estimates of actual emission levels in 1980. See e-mail from K. Timoffee, Acting Acid Rain Manager, Air Pollution Prevention Directorate, Environment Canada, to K. Wyman (16 May 2002) (confirming that the 1997 Annual Report contains estimates of actual emissions).

124. In 1981, a federal parliamentary committee concerned with acid rain recommended that 'governments consider innovative acid rain control regulatory alternatives which have been tried with some success in other countries - for example the Bubble Concept, Emission Offsets and Credits, etc.' See Canada, House of Commons, Sub-Committee on Acid Rain of the Standing Committee on Fisheries and Forestry, 'Still Waters' (1981) at 86-7, cited in Canada, House of Commons, Special Committee on Acid Rain, 'Report of the Special Committee on Acid Rain' Issue No. 24 (September 1988) at 81.

A 1983 report commissioned by the Ontario Ministry of the Environment specifically addressed the relative costs of various approaches for reducing sulphur dioxide emissions in the province, including a transferable emission rights scheme. See Peat, Marwick and Partners in association with W.A. Sims, *Economic Incentive Policy Instruments to Implement Pollution Control Objectives in Ontario: Report Prepared for Policy and Planning Branch, Ministry of the Environment (July 1983)* (Toronto: Queen's Printer for Ontario, 1990) [hereinafter *Economic Incentive Policy*].

Between 1983 and 1985, an economic mechanisms working group, composed of federal and provincial officials reporting to a federal-provincial steering committee concerned with acid rain, examined the possible use of instruments such as tradeable rights. Although the report was submitted to the steering committee, it was never discussed by federal and provincial ministers. See Long Range Transport of Air Pollutants Economic Mechanisms Work Group, *Analysis of Policies to Implement an Acid Rain Abatement Strategy* (17 December 1984) at 26-8 [unpublished, on file with author]; Macdonald, *Policy Communities*, supra note 123 at 277, 212-3, 199-200.

In the summer of 1985, the Ontario Minister of the Environment considered, but rejected, a proposal for an Ontario-only emissions trading regime for sulphur dioxide prepared by an economist within his ministry. See Memorandum from J. Donnan, Senior Economist, Policy and Planning Branch, Ontario Ministry of the Environment, to M. Rudolph, Chairman 'A' Team, Minister's Office, Ontario Ministry of the Environment (23 August 1985) [unpublished, on file with author] [hereinafter *Donnan Memorandum*] (describing a possible tradeable emission rights program for Ontario); Macdonald, *Policy Communities*, supra note 123 at 286; text accompanying note 137 infra.

After the passage of the US sulphur dioxide trading program in 1990, interest in emissions trading expanded significantly in Canada, and a number of studies considered the feasibility of a Canadian sulphur dioxide trading regime. See National Economic Research Associates Inc., *An Emission Trading Program for Sulphur Dioxide Sources in Canada: Prepared for Emission Trading Working Group, Canadian Council of Ministers of the Environment* (Cambridge, MA: Marsh & McLennan Company, 1993) [hereinafter *Emission Trading Program*]; Canada, Environment Canada, *Feasibility of Emissions Trading for Sulphur Dioxide Management in Atlantic Canada*, vol. 1, by Sawyer EnviroEconomics Consulting in consultation with the Emissions Trading Project Team, Environment Canada and Industry Canada (1995) [hereinafter *Feasibility of Emissions Trading in Atlantic Canada*]. These studies generally considered the potential for trading within zones made up of one or more of the eastern Canadian provinces where the effects of acid deposition are experienced most acutely. The focus on trading within individual provinces, or groupings of provinces, is at odds with the

national scope of the sulphur dioxide trading program ultimately adopted in the United States. But see Nash & Revesz, 'Markets and Geography,' supra note 27 (discussing the attention given to the regional character of sulphur dioxide emissions before and after the passage of the US sulphur dioxide trading program).

125. See Canada, Commissioner of the Environment and Sustainable Development, *2000 Report* (2000) at paras. 7.28-7.30, online: Commissioner of the Environment and Sustainable Development <http://www.oag-bvg.gc.ca/domino/reports.nsf/html/c0menu_e.html> (date accessed: 14 May 2002) (discussing the Canada-Wide Acid Rain Strategy for Post-2000 signed by federal and provincial ministers in 1998). The four provinces that have established additional SO₂ emission reduction targets are Ontario, Quebec, New Brunswick, and Nova Scotia.

The significant role of the provinces in establishing and allocating reduction targets reflects the importance of the provinces in the environmental field. See *Economic Surveys*, supra note 7 at 122 ('for many resource and environmental areas and issues, responsibility is shared between the federal and provincial governments, implying that the two levels of government have to co-operate to act effectively'). See also K. Harrison, 'The Origins of National Standards: Comparing Federal Government Involvement in Environmental Policy in Canada and the United States' in P.C. Fafard & K. Harrison, eds., *Managing the Environmental Union: Intergovernmental Relations and Environmental Policy in Canada* (Kingston, ON: School of Policy Studies, Queen's University, 2000) 49 (comparing the roles of the federal and subnational governments in the environmental area in Canada and the United States).

126. Several studies of the feasibility of using trading in nitrogen oxides and volatile organic compounds to address ground-level ozone in selected areas of Canada emerged from the NO_x/VOC Management Plan, developed in 1988-1990 by the Canadian Council of Ministers of the Environment See generally G.B. Doern, 'Regulations and Incentives: The NO_x-VOCs Case' in G.B. Doern, ed., *Getting It Green: Case Studies in Canadian Environmental Regulation* (Toronto: C.D. Howe Institute, 1990) 89; National Economic Research Associates Inc., *Emission Trading Program*, supra note 124 at E-3-E-4, 20. In recent years, Canada also has considered the feasibility of implementing a domestic tradeable rights program to control greenhouse gas emissions. See *Discussion Paper on Canada's Contribution*, supra note 11; *Using Tradeable Emissions Permits*, supra note 11.

127. After the public concern about smog in urban areas that emerged in the 1980s came to 'a head' in 1988 due to '[a] historically bad smog season,' the federal and provincial governments developed a NO_x/VOC Management Plan. However, most of the elements of the plan were never implemented, in part because of the economic retrenchment of the early 1990s. Only recently has there been a renewed initiative on the part of the federal and provincial governments to address smog through the Canada-Wide Standards process and the Ozone Annex to the 1991 U.S.-Canada Air Quality Agreement, signed in December 2000. See Commissioner of the Environment and Sustainable Development, *2000 Report*, supra note 125 at paras. 4.124, 4.228-4.233 (describing the fate of the NO_x/VOC Management Plan and the recent Canada-Wide Standards process); Canada, Environment Canada, *Backgrounder: Canada-United States Ozone Annex*, online: GreenLane, Environment Canada <http://www2.ec.gc.ca/press/001207_b_e.htm> (last modified: 17 July 2000) [hereinafter Environment Canada Backgrounder].

Under the Ozone Annex, Canada has agreed to cap annual total emissions of NO_x from fossil fuel-fired power plants with a capacity greater than 25 megawatts at 39 kilotonnes for a region in Ontario and 5 kilotonnes for a region in Quebec. See Protocol Between the Government of Canada and the Government of the United States of America Amending the *Agreement*

Between the Government of Canada and the Government of the United States of America on Air Quality, Canada and the United States, 13 October 2000, at Annex 3, Part III, A, s. 2(b) [hereinafter 'Ozone Annex'].

128. In light of the limited use of cost-benefit analysis in Canadian environmental and natural resource regulation, it would be difficult to sustain a claim that the Canadian pattern is due to specific expectations of the gains from using trading in the fisheries, where markets have been implemented, and in the pollution context, where, to date, trading has not been used extensively. See, e.g., J. Ibbitson, 'Clean-Air Measures Have the Smell of Taxation' *The Globe and Mail* (27 March 2001) A20 [hereinafter 'Clean-Air Measures'] (noting that the Ontario government has stated that it has not calculated the cost of new emissions targets). But see EB Economics, *Evaluation Report: Evaluation Study of Individual Quota Management in the Halibut Fishery* (October 1992) at 5, 16 (estimating *ex post* the gain to society from the halibut individual quota system, as it was structured in August and September 1992); B. Turris & C. Sporrer, 'Sablefish IVQ Program' in Canada, Policy and Economics Branch, Department of Fisheries and Oceans, *Experience with Individual Quota and Enterprise Allocation (IQ/EA) Management in Canadian Fisheries, 1972-1994* (November 1994) Part B, 63 at 68 (estimating *ex post* the gain to society from the sablefish individual vessel quota program, as of 1991).

129. Ackerman & Stewart, 'Reforming Environmental Law,' *supra* note 30 at 179.

130. See J.F. Castrilli in association with Pollution Probe, 'Legal Authority for Emissions Trading in Canada, Submitted to Pilot Emission Reduction Trading' in E. Atkinson, *The Legislative Authority to Implement a Domestic Emissions Trading System, Prepared for Multistakeholder Expert Group on Domestic Emissions Trading, National Round Table on the Environment and the Economy* (Ottawa: National Round Table on the Environment and the Economy, 1999) Appendix 1. See also Macdonald, *Policy Communities*, *supra* note 123 at 194 (referring to discussions within Environment Canada in the early 1980s about the possibility of direct federal action to reduce sulphur dioxide emissions).

131. Federal government documents and commissioned reports from the early 1990s that I have reviewed suggest that the federal government would have implemented emissions trading only with the agreement of the provinces, and likely within zones. See Canada, Environment Canada, *Economic Instruments for Environmental Protection: Discussion Paper* (Ottawa: Government of Canada, 1992) at 22, 29 [hereinafter *Economic Instruments for Environmental Protection*]. A comprehensive proposal for sulphur dioxide trading in Canada, prepared in 1993 by an outside consultant, recommended trading within several zones, apparently at the insistence of environmental regulators who commissioned the study. See National Economic Research Associates Inc., *Emission Trading Program*, *supra* note 124.

132. See note 125 *supra*.

133. See National Economic Research Associates Inc., *Emission Trading Program*, *supra* note 124 at 87, noting that 'Canada does not divide neatly into separate, well-defined airsheds.'

134. Figures for Ontario's share of eastern Canadian sulphur dioxide emissions are derived from *1997 Annual Report*, *supra* note 123 at 4 (identifying total SO₂ emissions by province). As noted above, 1980 emission levels were revised throughout the 1980s (see note 123 *supra*). Notably, however, the 1980 base case levels released with the February 1985 apportionment announcement and the base case numbers ratified by regulators in the fall of 1983 both suggest that Ontario was responsible for a similar percentage of eastern Canadian emissions (49 per cent) as the 1998 Environment Canada publication on which I am relying. See *Countdown Acid Rain*, *supra* note 123 at 5; Macdonald, *Policy Communities*, *supra* note 123 at 124; Endicott Memorandum, *supra* note 123 at Table 1A (base case sulphur dioxide

emissions for acid rain abatement programs).

135. See Peat, Marwick and Partners, *Economic Incentive Policy*, supra note 124 at V-10 (identifying Falconbridge, Inco, and Algoma as '[l]ow cost emitters' with 'average cost per tonne abated of 56 to 197 dollars') and Exhibit V-4 (Summary of Abatement Strategies and Associated Costs). See also Donnan et al., 'Results and Performance,' supra note 123 at Table 5 (*Ex Ante* Least-Cost Abatement Cost Function for Inco), Table 6 (*Ex Ante* Least-Cost Abatement Cost Function for Falconbridge), and Table 12 (*Ex Ante* Abatement Cost Function for Algoma Ore Division, Wawa).

Donnan et al.'s tables and the Peat, Marwick report suggest that among the three low-cost abaters, Algoma was the highest-cost abater per tonne of sulphur dioxide removed. As between Inco and Falconbridge, Inco was the higher-cost abater, except at more stringent levels of emission reductions, when Inco's abatement costs were expected to be lower than Falconbridge's.

136. See Peat, Marwick and Partners, *ibid.* at V-10 (identifying Ontario Hydro and the refineries as '[h]igh cost emitters' with 'average cost per tonne abated of 953 to 1439 dollars') and Exhibit V-4 (Summary of Abatement Strategies and Associated Costs). See also Donnan et al., 'Results and Performance,' supra note 123 at Table 5 (*Ex Ante* Abatement Cost Function for Ontario Hydro Power Plants). See Appendix C *infra*, which identifies the relative shares of Ontario emissions contributed by the four major provincial sources: Inco, Ontario Hydro, Algoma, and Falconbridge.

137. Donnan Memorandum, supra note 124 at 9-10 (describing a possible tradeable emission rights program for Ontario). See also Macdonald, *Policy Communities*, supra note 123 at 286 (referring to Donnan's proposal).

138. Figures for Atlantic Canada's share of eastern Canadian sulphur dioxide emissions are derived from *1997 Annual Report*, supra note 123 at 4 (identifying total SO₂ emissions by province).

As noted above, 1980 emission levels were revised throughout the 1980s (see note 123 *supra*). Notably, however, the 1980 base case levels released with the February 1985 apportionment announcement and the base case numbers ratified by regulators in the fall of 1983 both suggest that the four Atlantic Canadian provinces were responsible for a similar percentage of eastern Canadian emissions (11 per cent) as the 1998 Environment Canada publication on which I am relying. See *Countdown Acid Rain*, supra note 123 at 5; Macdonald, *Policy Communities*, supra note 123 at 124; Endicott Memorandum, supra note 123 at Table 1A (base case sulphur dioxide emissions for acid rain abatement programs).

139. Telephone interview with J. Kozak, Manager, Environment Canada, Toxics Management (16 May 2001).

140. *Feasibility of Emissions Trading in Atlantic Canada*, supra note 124 at 13, 25. However, it should be noted that the study did not recommend an Atlantic-only trading regime, seemingly because of uncertainty among stakeholders about trading and a lack of provincial interest in trading. Another factor influencing the report's conclusion appears to have been 'the high proportion of ... sulphur' imported into Atlantic Canada. See *ibid.* at iii.

141. Fraser & Jones, 'Enterprise Allocations,' supra note 23 at 267.

142. See Canada, Office of the Auditor General, *1997 Report* (Ottawa: Office of the Auditor General, 1997) at para. 14.56: 'The capacity of the groundfish harvesting industry is a term

that is not easily defined, and on which there is little agreement. The government has focused on the number of licence holders or the number of people the industry can employ. While these are important components of harvesting capacity, the risk of overfishing due to the ability and need of the industry to catch fish is also a component. This brings in the concepts of capital investment in technology, major improvements in the ability of improved technologies to catch fish and desired levels of income for those participating in the fishery.'

143. Pearse, 'Fishing Rights,' supra note 21 at 13.

144. *Turning the Tide*, supra note 50 at 75 ('The central economic problem of the commercial fisheries [in the Pacific] is the chronic overcapacity of the fleets'); Task Force on Atlantic Fisheries, *Navigating Troubled Waters*, supra note 121 ('In some areas there is too much harvesting capacity, relative to current and anticipated resource availability, to generate adequate annual incomes and adequate returns on investment for fishermen'). See also Task Force on Incomes and Adjustment in the Atlantic Fishery, *Charting a New Course*, supra note 49 at 14, 53-9 (describing '[t]he fundamental problems of the fishery' as 'overdependence on the fishery, pressure on the resource, and industry overcapacity' and discussing individual quotas as one mechanism for reducing overcapacity but not explicitly endorsing individual quotas on the basis that the Task Force 'did not consider detailed policies or programs to achieve' capacity reductions); Independent Panel on Access Criteria For the Atlantic Coast Commercial Fishery, *Report of the Independent Panel on Access Criteria* (March 2002) at 7 ('The two most significant reports on Atlantic Canada fisheries in the last quarter of the 20th century are the *Report of the Task Force on Atlantic Fisheries* (Kirby Report, 1982) and the *Report of the Task Force on Incomes and Adjustment in the Atlantic Fishery* (Cashin Report, 1993). Both reports stress the problem of overcapacity').

145. *Turning the Tide*, supra note 50 at 76 ('I have no doubt that our catches of salmon and roe-herring could be taken with fleets half their present size and at half the cost now expended in fishing'); 1990 study by the Department of Fisheries and Oceans quoted in Task Force on Incomes and Adjustment in the Atlantic Fishery, *Charting a New Course*, supra note 49 at 57 ('"massive overcapacity exists in both the harvesting and processing sector in Atlantic Canada." While there were variations between different industry sectors and provinces, excess capacities of 50 per cent and more were found to be common in all sectors and regions'); Task Force on Incomes and Adjustment in the Atlantic Fishery, *Charting a New Course*, supra note 49 at 56 (in light of declines in groundfish stocks, '[w]e ... must plan for a reduction in both harvesting and processing capacity of about 40 to 50 per cent'); Brubaker, 'Unnatural Disaster,' supra note 87 ('The [federal] Department of Human Resources reports a general consensus that the fishery can support half as many fishermen and plant workers as it has in the past.... The Fisheries Resource Conservation Council has recommended greater capacity reductions, ranging from a factor of two to a factor of four ...' [citations omitted]).

See also Office of the Auditor General, *1997 Report*, supra note 142 at para. 14.42 (citing 'a now-public 1970 Cabinet memorandum'): 'Canada's commercial catch in 1970 could be harvested by 40 percent of the boats, half as much gear and half the number of fishers.'

Notwithstanding the global estimates contained in government-commissioned reports of overcapacity on the Atlantic and Pacific coasts, assessments of industry capacity in Canada have tended to be localized studies, focusing on harvesting and processing capacity for specific species, in specific geographic areas. E-mail from B. Vézina, Senior Advisor, Atlantic Licensing and Enterprise Allocations Policy, Resource Management Branch - Atlantic, Fisheries and Oceans Canada, to K. Wyman (6 April 2001).

146. See Task Force on Incomes and Adjustment in the Atlantic Fishery, *Charting a New Course*, supra note 49 at 57 (referring to the findings of a 1989 industry-led committee). See

also Canada, Department of Fisheries and Oceans, Scotia-Fundy Region, *Capacity Management For the Groundfish Industry: A Study of the Western Scotia-Fundy Small Vessel Fleet* (Halifax: Department of Fisheries and Oceans, March 1986) at 8.

147. See *Turning the Tide*, supra note 50 at 76.

148. See text accompanying notes 100-5 supra (discussing the mechanisms by which individual quotas promise to generate welfare gains by reducing overcapacity in the fisheries).

149. Dupont, 'Limited Entry Fishing,' supra note 115 at 109.

150. Ibid. Following Scott and Munro, Dupont defines the rent dissipation that occurs in the face of a total allowable catch as a 'Class II type of rent dissipation.' A 'Class I form rent dissipation' occurs in the absence of a total allowable catch established by regulators.

151. Ackerman & Stewart, 'Reforming Environmental Law,' supra note 30 at 180.

152. Ibid. See also National Center for Environmental Economics, *US Experience*, supra note 3 at 15 ('Economic instruments avoid the problems that a pollution control agency would have in identifying the least cost methods of meeting a pollution control objective by harnessing market forces to identify cost-effective solutions'); A.V. Kneese & C.L. Schultze, *Pollution, Prices, and Public Policy* (Washington, DC: Brookings Institution, 1975) at 88 ('[i]n theory, a regulatory agency could devise an efficient plan for uniform reduction of pollution'); N. Kete, *The Politics of Markets: The Acid Rain Control Policy in the 1990 Clean Air Act Amendments* (Ph.D. Dissertation, Johns Hopkins University 1993) at 288 [hereinafter *Politics of Markets*] ('SIP [state implementation plan] limits could be, but typically have not been, decided on the basis of the results of optimization modeling').

153. See Krier & Montgomery, 'Resource Allocation,' supra note 106 at 98 (discussing the time and effort that implementing variable standards for pollution sources would require of regulators).

154. See generally G. Hoberg, 'Governing the Environment: Comparing Canada and the United States' in K. Banting, G. Hoberg, & R. Simeon, eds., *Degrees of Freedom: Canada and the United States in a Changing World* (Montreal: McGill-Queen's University Press, 1997) 341 at 348-56, 362, 376-9 (discussing the differences between the institutions through which environmental policy is formulated in Canada and in the United States and referring to the greater discretion Canadian regulators enjoy by comparison with their US counterparts); McCay et al., 'Individual Transferable Quotas,' supra note 25 at 91-3 (comparing the regulatory process in the fisheries context in Canada and the United States and noting the greater latitude enjoyed by Canadian regulators compared with their US counterparts).

155. Compare Kete, *Politics of Markets*, supra note 152 at 171-2: if the United States had not adopted a sulphur dioxide trading program, the Environmental Protection Agency (EPA) would likely have assigned each state a target, and then the states would have allocated their targets among their sources. At every step, the 'the affected utilities' would have been able to raise concerns 'over data, responsibility, impact, and every other point imaginable by teams of lawyers.'

156. While US regulators might be able to defend successfully individualized targets, the resources required to develop such targets for a large number of sources, and the likelihood that the targets would be challenged in court, would seem to diminish the attractiveness of formulating source-specific standards in the first place.

157. See Dewees, 'Regulation of Sulphur Dioxide,' supra note 7 at 150, where the author notes that in a small market, 'two objectives of' emissions trading, 'to equate marginal costs of abatement among all sources and to learn the marginal cost of abatement, will be achieved only imperfectly. Furthermore, with this thin market, the small sources ... may not be well treated if they wish to buy rights from the large sources'); F.C. Menz, 'Transborder Emissions Trading between Canada and the United States' (1995) 35 Nat.Res.J. 803 at 813 [hereinafter 'Transborder Emissions Trading'] ('A concern in implementing an emissions trading program [for sulphur dioxide] in Canada is the thinness of the potential market for emissions allowances because most of Canada's SO₂ emissions come from a small number of sources' [citation omitted]).

158. See *1997 Annual Report*, supra note 123 at 5 (major SO₂ sources) and 4 (total SO₂ emissions by province). See also Appendix B infra. I focus on the small number of sources of eastern Canadian emissions principally because acid rain control has focused on eastern Canada, since acid deposition remains below critical loads in Western Canada. See The Acidifying Emissions Task Group, *Towards a National Acid Rain Strategy, Submitted to the National Air Issues Coordinating Committee* (1997) at iv. In any event, it should be noted that emissions from the seven provinces in the eastern Canadian acid rain program accounted for 80 per cent of total national emissions in 1985. See *Economic Instruments for Environmental Protection*, supra note 131 at 28.

159. I refer to each smelter or generating facility as a single point source (or facility). However, it should be noted that one generating facility may include multiple units or stacks.

160. See Appendix B infra. Consider, by comparison, the number of power plants initially included in Phase I of the US acid rain program. In 1995, when Phase I began, 110 power plants owned by 61 utilities were covered. These power plants encompassed 263 units. See A.D. Ellerman et al., 'Emissions Trading Under the U.S. Acid Rain Program: Evaluation of Compliance Costs and Allowance Market Performance' (Cambridge, MA: MIT Center for Energy and Environmental Policy Research, October 1997) at 8, online: Massachusetts Institute of Technology <<http://web.mit.edu/ceepr/www/napap.pdf>> (date accessed: 15 May 2002).

161. As previously mentioned, 46 per cent of eastern Canadian emissions came from Ontario in 1980. See text accompanying note 134 supra.

162. Information about responsibility for emissions within Ontario is derived from *1997 Annual Report*, supra note 123 at 5 (identifying major SO₂ sources) and 4 (identifying total SO₂ emissions by province), and is summarized in Appendix C infra.

As noted above, assessments of 1980 emission levels were revised throughout the 1980s (see note 123 supra). Notably, however, the four major Ontario sources also accounted for 85 per cent of provincial emissions under the 1980 base case emission levels ratified by regulators in the fall of 1983. Under these 1980 base case levels, Inco accounted for 51 per cent of Ontario emissions and Ontario Hydro for 20 per cent. See Macdonald, *Policy Communities*, supra note 123 at 124; Endicott Memorandum, supra note 123 at Table 1A (base case sulphur dioxide emissions for acid rain abatement programs).

163. See generally Macdonald, *Policy Communities*, supra note 123.

164. See R. Howard & M. Perley, *Acid Rain: The North American Forecast* (Toronto: House of Anansi, 1980) at 118-9 ('In Canada ... there are no anticipated hundreds of new coal-fired power plants which need strict emission controls'); *Countdown Acid Rain*, supra note 123 at 6 ('In 1984, electricity was produced about equally from water, coal and nuclear plants, with coal

used as the peaking and reserve fuel. As more nuclear plants come on stream between now and 1992, coal use will decline until the mid-1990s. After that, the projected increased demand is expected to require increasing use of coal as the [currently mothballed] fossil-fuel plants are brought back into use'). See also Ontario, Ministry of the Environment, *Coal-Fired Electricity Generation in Ontario* (2001) at 14 [hereinafter *Coal-Fired Electricity Generation in Ontario*] (indicating that in 1999, Ontario Power Generation generated approximately 46.7 per cent of its electricity from nuclear sources, 27.8 per cent from fossil fuel-fired sources, and 25.6 per cent from hydroelectric sources).

165. See Appendix B *infra*. The share of eastern Canadian emissions released by the eight corporations in 1997 is derived from *1997 Annual Report*, *supra* note 123 at 5 (major SO₂ sources) and 4 (total SO₂ emissions by province).

166. The number of quota programs that have been established provides only an approximate indication of the number of negotiations that would have been required because negotiations might have been configured differently from quota programs. For example, fishing fleets that have been separated for the purposes of establishing quota programs might have been combined if regulators had attempted to negotiate the benefits of quota programs *ex ante*.

167. See L.S. Parsons & W.H. Lear, 'Introduction' in L.S. Parsons & W.H. Lear, eds., *Perspectives on Canadian Marine Fisheries Management* (Ottawa: Department of Fisheries and Oceans, 1993) 1 at 4 (referring to 'the diversity of the fishery resources and the fisheries which exploit them' and noting that '[s]olutions to fisheries problems must take account of this diversity'); Scott & Neher, *Public Regulation of Commercial Fisheries*, *supra* note 113 at 39 ('The diversity and complexity of Canadian fisheries suggests that *no single management scheme is appropriate* for all of them' [original emphasis]).

168. Apostle et al., *Community, State, and Market*, *supra* note 66 at 152: Fisheries and Oceans 'is one of the most decentralized units in the federal government, with over three-quarters of the individuals employed by the department working outside Ottawa.'

169. I have obtained information about the initial number of quota holders from a variety of sources, including academic scholarship about Canada's individual quota programs, papers prepared by officials from the Department of Fisheries and Oceans, and telephone interviews and e-mail communications with fisheries regulators in the federal, Ontario, and Manitoba governments and with employees of the Ontario Commercial Fisheries' Association. D.L. Burke, Regional Director, Policy and Economics Branch, Department of Fisheries and Oceans Maritimes Region, has been particularly helpful in providing information about individual quota programs in Atlantic Canada.

In compiling information about the initial number of quota holders, I have attempted to determine the number of economically distinct entities initially allocated quotas. I have been concerned with the number of distinct entities initially holding individual quotas because my objective has been to assess the number of parties with whom regulators would have been required to negotiate an efficient allocation of harvesting capacity *ex ante* if conventional regulation had continued to be the means of regulating fishing effort. For example, if quotas were allocated to individual licences, and the ownership of licences was concentrated in the hands of several large fishing enterprises, then I have attempted to determine the number of fishing enterprises that owned licences, rather than the number of licences to which individual quotas were attached. I have varying levels of comfort with the information that I have collected about the number of distinct entities initially allocated quotas.

In a number of instances where I have not been able to determine the initial number of quota

holders, I have relied instead on the number of licence holders in a fishery at the time individual quotas were implemented. This reliance on the number of licence holders may result in an overestimation of the initial number of quota holders if individual parties held more than a single licence when individual quotas were implemented.

In other instances, where I have been unable to determine the initial number of quota holders when programs were introduced, I have used estimates of the number of quota holders in a subsequent year. For example, I have used estimates of the number of quota holders in five Ontario programs in 1994, even though individual quotas were introduced in Ontario lakes in 1984 (Lake Ontario, Lake Huron, Lake Superior, Lake Nipigon, and all other bodies of water in the province, which I have counted as one program). Relying on estimates of the number of quota holders in a subsequent year may underestimate the initial number of quota holders if quota holdings have been consolidated in the interim. See e-mail from D. Cartier, Data Systems Manager, Ontario Commercial Fisheries' Association, to K. Wyman (24 October 2001) (offering a 'best guess as to the number of commercial fishing licences' on various Ontario lakes in 1994, and the number of entities holding these licences, based on Ontario Ministry of Natural Resources data).

Finally, in two instances I have used the number of licence holders from a year after the implementation of individual quotas as a proxy for the initial number of quota holders. The number of licence holders for the programs covering fixed-gear cod-fishing vessels under sixty-five feet in Area 10 of 3Ps, and mobile-gear cod-fishing vessels under sixty-five feet in 3Ps, may underestimate the initial number of quota holders if licences have been retired from these fisheries since individual quotas were implemented.

170. These six programs are (1) the enterprise allocation program in Atlantic Canada for offshore clams established in 1987 (three initial quota holders); (2) the individual quota program covering vessels under sixty-five feet fishing cod using mobile gear in 3Ps implemented in 1998 (three initial quota holders); (3) the enterprise allocation program in Atlantic Canada for offshore lobster fishers established in 1985 (four initial quota holders); (4) the individual quota program extended in 1995 to snow crab in management area 20 in the Scotia-Fundy region (five initial quota holders); (5) the individual quota program extended in 1994 to snow crab in management area 15 in the Laurentian region in Atlantic Canada (eight initial quota holders); and (6) the individual quota program covering Lake Nipigon in Ontario implemented in 1984 (eight initial quota holders).

171. Furthermore, it is important to consider the origins of the six programs with eight or fewer initial quota holders within the broader pattern of the implementation of individual quota programs in Canada. The *enterprise allocation programs for offshore clams and lobsters* were established at a time when federal fisheries regulators were phasing in the use of property rights approaches in the offshore fishery. See L.S. Parsons, 'Shaping Fisheries Policy: The Kirby and Pearse Inquiries - Process, Prescription and Impact' in L.S. Parsons & W.H. Lear, eds., *Perspectives on Canadian Marine Fisheries Management* (Ottawa: Department of Fisheries and Oceans, 1993) 383 at 392 ('In announcing the government's acceptance of Kirby's recommended quota licensing system [in 1983], Minister De Bané indicated that the system would be phased in over the following three years, beginning with the offshore fleet'). Enterprise allocations are a form of individual quotas that are allocated to fishing enterprises, rather than to vessels or to licences.

The first enterprise allocation program was established in 1982 to cover the offshore groundfish sector in the Atlantic fishery. The program was implemented at the initiative of regulators, as part of a plan to address a financial crisis in the sector partly caused by 'overcapacity of production.' Fraser & Jones, 'Enterprise Allocations,' supra note 23 at 273. The program initially covered a total of twenty-three enterprises, operating approximately 150

vessels in the offshore groundfish sector. However, four enterprises initially dominated the program, controlling a total of 124 trawlers in 1982. But the number of vessels that these four enterprises owned, and the existence of other, albeit smaller, companies, likely would have made it difficult to replicate the economic benefits of the enterprise allocation program through informal negotiations. As a historical matter, the offshore groundfish program seems to have provided the impetus for implementing other enterprise allocation programs in Atlantic Canada by generating industry support for the concept. See B. Huson, 'Offshore Groundfish Enterprise Allocation (EA) Program' in Policy and Economics Branch, Department of Fisheries and Oceans, *Experience with Individual Quota and Enterprise Allocation (IQ/EA) Management in Canadian Fisheries, 1972-1994* (November 1994) Part B, 46 at 48; Gardner, 'Enterprise Allocation System,' *supra* note 49 at 296; Fraser & Jones, *ibid.* at 287.

Notably, the offshore groundfish enterprise allocation program is not alone in having been introduced at the initiative of regulators. See, *e.g.*, Canada, Standing Senate Committee on Fisheries, 'Privatization and Quota Licensing,' *supra* note 38 (describing 'the tide of privatization of fishing rights' beginning in the early 1980s as '[v]ery much a bureaucratic initiative'); Barbara et al., 'Scotia-Fundy Inshore Mobile Gear,' *supra* note 67 at 26 (the individual transferable quota program covering the Scotia-Fundy mobile-gear inshore fleet was implemented as a result of a decision by the Minister of Fisheries and Oceans, and 'there was not a great deal of industry support for this new management system' at its inception); *Carpenter Fishing*, *supra* note 33 at 88 (the halibut individual vessel quota program in British Columbia was established because the Department of Fisheries and Oceans 'wanted a quota system'). However, as in the case of the offshore groundfish enterprise allocation program, fishing communities that originally opposed individual quota programs have often grown to support them after implementation, presumably because these programs increase the net returns from the fishery. See, *e.g.*, Barbara et al., *ibid.* at 25 (in spite of the initial lack of support for the individual transferable quota program for the Scotia-Fundy mobile gear inshore fleet, 'the majority of participants who remain[ed] in the ITQ program three years later generally support[ed] it,' and 'the participants elected to make it permanent').

The two individual quota programs in *snow crab fisheries* with eight initial quota holders or fewer might be explained as extensions of programs initiated earlier in neighbouring management areas. For example, the individual quota program in area 20 in Scotia-Fundy was introduced a year after individual quotas were implemented in area 23 (twenty-two initial quota holders) and in the same year as individual quotas were established in areas 21 (thirty-two quota holders), 22 (thirty-seven quota holders), and 24 (twenty-one quota holders). Similarly, the individual quota program in area 15 in the Laurentian region was introduced after quotas were introduced in 1986 in areas 13 (forty-three initial quota holders) and 14 (twenty-one initial quota holders) and at the same time that individual quotas were introduced in areas 16 (thirty-two initial quota holders) and 17 (twenty-two initial quota holders). However, it should also be noted that the programs covering areas 16 and 17 in the Newfoundland and Laurentian regions represent instances in which individual quotas have been established in lucrative fisheries with abundant stocks, at the behest of fishers, whose underlying motivations may have included securing rents and erecting barriers to new entrants. See, *e.g.*, Policy and Economics Branch, Department of Fisheries and Oceans, *Experience with IQ/EA Management*, *supra* note 62 (discussing the quota programs established in the early 1990s covering the inshore scallop fishery in the Middle North Shore in Areas 16D, 16E, 16G, and 18A in Quebec and the inshore snow crab fishery in Areas 16 and 17 in Quebec); S. Heizer, 'The Commercial Geoduck (*Panopea abrupta*) Fishery in British Columbia, Canada: An Operational Perspective of a Limited Entry Fishery with Individual Quotas' in R. Shotton, ed., *Use of Property Rights in Fisheries Management: Proceedings of the FishRights99 Conference, Fremantle, Western Australia, 11-19 November 1999, Workshop Presentations, FAO Fisheries Technical Paper 404/2* (Rome: Food and Agriculture Organization of the United

Nations, 2000) 226 at 228 (the British Columbia geoduck program was established at the request of industry using industry funds); Keohane et al., 'Choice of Regulatory Instruments,' supra note 2 at 350-1 (where pollution permits are distributed for free to existing firms, these firms obtain rents through the initial allocation and a barrier to new entrants through the requirement that new entrants purchase permits). In general, the implementation of individual quotas would seem to have become less controversial over time. See Burke & Brander, 'Canadian Experience,' supra note 14 at 157.

The programs covering *Lake Nipigon* in Ontario, and *vessels under sixty-five feet* fishing cod using mobile gear in region 3Ps off Newfoundland, were implemented at the same time as other programs in these jurisdictions. The Lake Nipigon program was implemented when Ontario introduced individual transferable quotas in lakes across the province in 1984. The program covering mobile-gear cod fishers in region 3Ps was introduced after the moratorium on fishing cod in the region was lifted and at the same time as an individual quota program covering fixed-gear cod fishers in Area 10 of region 3Ps (526 quota holders as of 2001). Telephone interview with D. Tobin, Acting Staff Officer, Licensing, Department of Fisheries and Oceans Newfoundland Region (22 April 2002).

172. Macdonald, *Policy Communities*, supra note 123 at 144; Donnan et al., 'Results and Performance,' supra note 123 at 9, 13.

173. Macdonald, *ibid.* at 147. See also Donnan et al., *ibid.* at 9.

174. See Macdonald, *ibid.* at 145-6; Donnan et al., *ibid.* See also Donnan et al., *ibid.* at 13 (describing the sources for the site-specific estimates of the abatement costs at the four major Ontario sources); Macdonald, *ibid.* at 152-3 (referring to the importance of the Ontario/Canada Task Force for the Development and Evaluation of Air Pollution Abatement Options for Inco Limited and Falconbridge Nickel Mines, which was established in 1980 and reported in 1982). See Ontario/Canada Task Force for the Development and Evaluation of Air Pollution Abatement Options for Inco Limited and Falconbridge Nickel Mines, Limited in the Regional Municipality of Sudbury, Ontario, *Final Report* (1982).

175. See Macdonald, *ibid.* at 145-6. See also *ibid.* at 144 (indicating that the Ontario database was developed 'primarily because the fledgling economic analysis section of the [Ontario] Ministry [of the Environment] suggested to policy makers that abatement options should be considered not only on the basis of the modelling of source-receptor relationships which had been done [by the early 1980s] but also should include the criteria of different abatement costs for different sources').

It is noteworthy that the Ontario database also included generic estimates for reductions at US sources, '[r]eflecting the commonly held view at the time that any acid rain program must be a co-ordinated effort by Canada and the United States,' and the roots of the database in research conducted by a Canada-US working group. *Ibid.* at 146.

176. See note 123 supra, discussing the significance of the 50 per cent reduction target.

177. Minutes of Meeting of Provincial Environment Ministers on Acid Rain (Toronto, 30 May 1983) at 2 [unpublished, on file with author]. For a brief description of the options likely considered by the provincial environment ministers at this meeting as a basis for apportioning emission reductions, see Ontario, Ministry of the Environment, Meeting of Provincial Ministers: Acid Rain Abatement Strategy (May 1983) at 3-6 [unpublished, on file with author]. See also Macdonald, *Policy Communities*, supra note 123 at 204.

178. Resolution of the Meeting of Eastern Provincial Ministers (Manitoba, Ontario, Quebec, New

Brunswick, Nova Scotia and Newfoundland) (30 May 1983) [unpublished, on file with author].

179. Memorandum from D. Trick, International Relations Branch, Ontario Ministry of Intergovernmental Affairs, to J. Carson, Director, International Relations Branch, Ontario Ministry of Intergovernmental Affairs (2 June 1983) at 3 (explaining the implications of the resolution to which provincial environment ministers agreed at the 30 May 1983 meeting). For another explanation of the 'most cost effective, receptor oriented strategy' see Long Range Transport of Air Pollutants Economic Mechanisms Work Group, *supra* note 124 at 6: 'A least cost targeted approach has been agreed upon in principle. This approach minimizes the total cost to emitters while maximizing environmental benefit in terms of reduced deposition at sensitive receptor areas. It implies acting first on large sources of SO₂ which impinge on sensitive areas. Emissions are reduced by targeting emitters with lower abatement costs before sources with high costs are dealt with. The least cost is based on each unit deposition reduced in sensitive areas.'

180. See Cropper & Oates, 'Environmental Economics,' *supra* note 1 at 689 ('For certain pollutants ... studies make clear that a substantial portion of the cost-savings from economic-incentive approaches will be lost if spatial differentiation is not, at least to some degree, built into the program' [citation omitted]). See Nash & Revesz, 'Markets and Geography,' *supra* note 27 at 578 (the shape of the damage function determines whether restricting trading to take into account the environmental effects of emissions of regional or local pollutants maximizes social welfare).

181. See Macdonald, *Policy Communities*, *supra* note 123 (describing the process by which the eastern Canadian target of a 50 per cent reduction from 1980 emission levels was allocated).

182. I recognize that the following paragraphs do not assess the extent to which the inter-provincial allocation reflected the economic ideal of equalizing marginal abatement costs. However, I am limited by my sources to assessing only the extent to which the inter-provincial allocation corresponded with the allocation principle formally articulated by the provinces in the 1980s.

183. See Donnan et al., 'Results and Performance,' *supra* note 123 at 15 ('Between the early part of 1982 and the end of 1985 ..., many estimates of potential emission reduction scenarios and their associated costs were made using the cost functions and the Screening Model'). Notably, a model reminiscent of Ontario's Screening Model, the Regional Acidification Information and Simulation (RAINS) model, was used in negotiating the Second Sulfur Protocol signed in 1994 under the United Nations Economic Commission for Europe Convention on Long-Range Transboundary Air Pollution. Unlike the First Sulfur Protocol, which required each signatory country to reduce its sulphur dioxide emissions by 30 per cent, the Second Sulfur Protocol imposed 'differentiated national emission reductions among countries, with some countries making significant reductions (up to 80 per cent) and others undertaking smaller reductions.' G. Klaassen, *Acid Rain and Environmental Degradation: The Economics of Emission Trading* (Brookfield, VT: Edward Elgar, 1996) at 2 [hereinafter *Acid Rain*]. Klaassen indicates that these differentiated national reduction targets were based on regional variations in critical loads for sulphur deposition, the differential impact of countries' emissions on sensitive areas because of atmospheric transport, differences in national pollution control costs, and political horse trading. See *ibid.* at 2, 3, 185-200, 208-9. I am grateful to Professor Richard Stewart for bringing Ger Klaassen's book to my attention.

184. Ontario, Ministry of the Environment, Cabinet Submission: Federal/Provincial Negotiations for a Strategy for the Control of Acid Rain (14 September 1983) at 8 (Least Cost Reduction of Canadian and U.S. Sources to Achieve a Deposition Target of 20 kg (SO₄) per Hectare Year)

[unpublished, on file with author] [hereinafter '1983 Scenario']; Briefing Documents: Federal/Provincial Environment Ministers Meeting, Ottawa, Ontario (1 June 1984) (Least Cost Reduction to Achieve Greatest Environmental Benefit and an Emission Ceiling of 2.3 Million Tonnes) [unpublished, on file with author] [hereinafter '1984 Scenario']; Least Cost 50% Canadian Reduction: Least Cost U.S. Reduction to Achieve Deposition of 20 kg/ha/yr in Canadian Receptors (given to Canadian Coalition on Acid Rain on 10 September 1985 to illustrate Ontario's Screening Model, according to handwritten note) [unpublished, on file with author] [hereinafter '1985 Scenario'].

185. The three provinces' shares of eastern Canadian emissions in 1980 are derived from *1997 Annual Report*, supra note 123 at 4 (identifying total SO₂ emissions by province).

As noted above, 1980 emission levels were revised throughout the 1980s (see note 123 supra). Notably, however, the 1980 base case levels mentioned in documents from the 1980s generally suggest that the three provinces accounted for similar shares of eastern Canadian emissions as are indicated by the 1998 Environment Canada document on which I am relying, although the documents from the 1980s refer to higher levels of emissions in absolute terms. For example, the 1980 base case levels released with the February 1985 apportionment announcement, and the 1980 base case numbers ratified by regulators in the fall of 1983, indicate that Ontario accounted for 49 per cent of eastern Canadian emissions, that Quebec accounted for 24 per cent, and that Manitoba was responsible for 16 per cent. See *Countdown Acid Rain*, supra note 123 at 5; Macdonald, *Policy Communities*, supra note 123 at 124; Endicott Memorandum, supra note 123 at Table 1A (base case sulphur dioxide emissions for acid rain abatement programs). See also the 1980 base case emission levels in the three ideal inter-provincial allocation scenarios I reviewed, which are identified at note 184 supra.

186. From the three scenarios that I have reviewed, it is possible to estimate that Ontario should have been responsible for 53 per cent ('1983 Scenario'), 61 per cent ('1984 Scenario'), or 64 per cent ('1985 Scenario') of the eastern Canadian reduction burden. See tables on file with author, derived from sources identified at note 184 supra.

187. The 1983 scenario that I reviewed suggests that Quebec should have been responsible for 23 per cent of eastern Canadian reductions, while Manitoba should have assumed responsibility for 15 per cent. The 1984 scenario suggests that Quebec should have been responsible for 16 per cent and Manitoba should have assumed 22 per cent of the eastern Canadian reduction burden. The 1985 scenario indicates that Quebec should have been responsible for 16 per cent of the eastern Canadian reduction burden and Manitoba should have assumed responsibility for 19 per cent of reductions. See tables on file with author, derived from the sources identified at note 184 supra.

188. Using the 1980 emission levels and 1994 emission limits identified in Environment Canada's 1997 annual report on the eastern Canada acid rain program, Ontario assumed responsibility for approximately 60 per cent of the total eastern Canadian reduction burden of 1 463 kilotonnes required to meet the total eastern Canadian 1994 cap of 2 349 kilotonnes. See table on file with author, derived from *1997 Annual Report*, supra note 123 at 4.

Similarly, using the 1980 provincial emission levels released with the February 1985 apportionment, and the 1994 Ontario and eastern Canada limits identified in Environment Canada's 1997 annual report, Ontario assumed responsibility for approximately 60 per cent of the total eastern Canadian reduction burden. Under this scenario, however, the total eastern Canadian reduction burden was 2 167 kilotonnes, rather than 1 463 kilotonnes. The burden was higher because the base case numbers released in February 1985 represented a combination of actual and allowable emission levels. See table on file with author, derived from *1997 Annual Report*, *ibid.*; and *Countdown Acid Rain*, supra note 123 at 5 (1980 base case

emission levels from February 1985). See also note 123 *supra* (briefly describing the history of the allocation process).

In suggesting that Ontario may have assumed a share of eastern Canadian reductions that was roughly in line with the most cost-effective, receptor-oriented principle, I do not intend to imply that Ontario agreed to its reduction target solely because it was committed to reducing emissions in the most environmentally sensitive areas at least cost. Ontario government documents from the early 1980s suggest that several factors influenced the province's ultimate decision on a reduction target, including the province's large share of eastern Canadian emissions, the many sensitive receptor areas influenced by Ontario's emissions, the relatively low abatement costs of Ontario's smelters, and the election in 1985 of a provincial Liberal government with a strong commitment to environmental protection. See generally *Cabinet Submission*, *supra* note 184 at 8; *Reasons Why Your Cabinet Colleagues Should Support Your Acid Rain Proposal* [undated and unpublished Ontario government memorandum, on file with author]; *Reasons Why the Unallocated 300,000 Tonnes of SO₂ Emissions Should Be Addressed Now* [undated and unpublished Ontario government memorandum, on file with author].

189. See note 186 *supra*.

190. As discussed at note 187 *supra*, under the scenarios that I reviewed, Quebec should have been responsible for 23 or 16 per cent of the eastern Canadian emission reduction burden.

Using the 1980 emission levels and the 1994 emission limits identified in Environment Canada's 1997 annual report on the eastern Canada acid rain program, Quebec assumed responsibility for approximately 41 per cent of the total eastern Canadian reduction burden of 1 463 kilotonnes required to meet the total eastern Canadian 1994 cap of 2 349 kilotonnes. See table on file with author, derived from *1997 Annual Report*, *supra* note 123 at 4. (As discussed at note 191 *infra*, using the figures provided in Environment Canada's 1997 report in this manner suggests that Manitoba was permitted to increase its emissions in spite of the 1994 cap.)

The 1980 provincial emission levels released with the February 1985 apportionment, and the Quebec and eastern Canada 1994 limits identified in Environment Canada's 1997 annual report, suggest that Quebec assumed responsibility for approximately 27 per cent of the total eastern Canadian reduction burden. Under this scenario, however, the total eastern Canadian reduction burden was 2 167 kilotonnes rather than 1 463 kilotonnes. The burden was (theoretically) higher because the base case numbers released in February 1985 represented a combination of actual and allowable emission levels. See table on file with author, derived from *1997 Annual Report*, *ibid.*; and *Countdown Acid Rain*, *supra* note 123 at 5 (1980 base case emission levels from February 1985). See also *supra* note 123 (briefly describing the history of the allocation process).

191. As discussed at note 187 *supra*, under the scenarios that I reviewed, Manitoba should have been responsible for 15, 22, or 19 per cent of the eastern Canadian emission reduction burden.

Using the 1980 emission levels and the 1994 emission limits identified in Environment Canada's 1997 annual report on the eastern Canada acid rain program, it is possible to argue that Manitoba's 1994 limit of 550 kilotonnes permitted the province to increase its emissions, since the province's actual emissions in 1980 amounted to only 484 kilotonnes. See table on file with author, derived from *1997 Annual Report*, *supra* note 123 at 4.

However, the 1980 provincial emission levels released with the February 1985 apportionment, and the 1994 limits for Manitoba and eastern Canada emissions identified in Environment

Canada's 1997 annual report, suggest that Manitoba would have been required to reduce its emissions to achieve its 1994 cap. In particular, this combination of figures suggests that Manitoba assumed responsibility for approximately 9 per cent of the total eastern Canadian reduction burden. See table on file with author, derived from *1997 Annual Report*, *ibid.*; and *Countdown Acid Rain*, *supra* note 123 at 5 (1980 base case emission levels from February 1985). See also note 123 *supra* (briefly describing the history of the allocation process).

192. The following descriptions of the intra-provincial allocation process in Ontario suggest that source-receptor relationships were not a factor in the allocation of Ontario's cap among its major corporate sources, notwithstanding the importance that these relationship may have assumed for the eastern Canadian provincial ministers as a group: Ernst & Young Management Consultants, *Options for Environmental Protection*, *supra* note 89 at 60; Ontario, Ministry of the Environment, *Countdown Acid Rain: Government Summary and Analysis of the Sixth and Final Planning Phase Progress Reports Submitted by Ontario's Three Major Emitters of Sulphur Dioxide in the Metallurgical Sector* (June 1989) at 3 ('The required reductions were apportioned among the sources after considering the estimated marginal cost of abatement within the realm of available technology, questions of equity with respect to control measures previously taken, and the economic environment for each of the sources').

Since my assessment of the regulatory program is based on information available to regulators in the 1980s, I also shift from considering the extent to which the allocation corresponded to a most cost-effective, receptor-oriented strategy to simply the least-cost strategy, based on differences in abatement costs among individual sources.

193. Inco's and Ontario Hydro's combined share of Ontario emissions in 1980 is derived from *1997 Annual Report*, *supra* note 123 at 4-5. Notably, under the 1980 base case emission levels ratified by regulators in the fall of 1983, the two sources accounted for a roughly analogous 71 per cent of Ontario emissions. See Macdonald, *Policy Communities*, *supra* note 123 at 124; Endicott Memorandum, *supra* note 123 at Table 1A (base case sulphur dioxide emissions for acid rain abatement programs). See Macdonald, *ibid.* at 125 (the regulatory program focused on the two largest sources); Donnan et al., 'Results and Performance,' *supra* note 123 at 18 (describing Inco and Ontario Hydro as 'the key sources').

The other two significant Ontario sources each accounted for less than 10 per cent of provincial emissions in 1980. Specifically, Algoma accounted for almost 9 per cent, and Falconbridge accounted for almost 7 per cent, of actual emissions in Ontario in 1980, according to *1997 Annual Report*, *supra* note 123 at 5 (major SO₂ sources) and 4 (total SO₂ emissions by province). According to the 1980 base case emission levels ratified by federal and provincial governments in the fall of 1983, Algoma and Falconbridge each accounted for a roughly analogous 7 per cent of Ontario emissions in 1980. See Macdonald, *ibid.* at 124; Endicott Memorandum, *ibid.* at Table 1A (base case sulphur dioxide emissions for acid rain abatement programs).

In the 1980s, Algoma was operating the plant responsible for its sulphur dioxide emissions - its sintering operation in Wawa - at less than full capacity, and the plant subsequently closed in 1998. See Donnan et al., *ibid.* at 30. In the 1970s, Falconbridge had installed new process technology that had reduced its sulphur dioxide emissions. See Ernst & Young Management Consultants, *Options for Environmental Protection*, *supra* note 89 at 60; Ontario/Canada Task Force, *Final Report*, *supra* note 174 at xvi, 4-5.

194. Indications of Inco's relatively low expected abatement costs compared with Ontario Hydro's are provided in Peat, Marwick and Partners, *Economic Incentive Policy*, *supra* note 124 at Exhibit V-4 (estimating after-tax annual costs per tonne of sulphur dioxide abated at Inco at \$65.00 or \$97.00, depending on the strategy selected, and at \$953.00, \$962.00, \$954.00, and

\$1150.00 at Ontario Hydro, depending on the strategy selected); Donnan Memorandum, supra note 124 at Table 1 (estimating before-tax annual costs per tonne of sulphur dioxide abated at Inco at \$156.00 or \$240.00, depending on the strategy selected, and at \$1129.00, \$1113.00, \$1183.00, or \$1434.00 at Ontario Hydro, depending on the strategy selected); Donnan et al., 'Results and Performance,' supra note 123 at Table 5 (*Ex Ante* Least-Cost Abatement Cost Function for Inco) and Table 8 (*Ex Ante* Abatement Cost Function for Ontario Hydro Power Plants).

See also Ernst & Young Management Consultants, *Options for Environmental Protection*, supra note 89 at 66 (referring to information about the expected abatement costs of Inco and Ontario Hydro that suggests that Ontario Hydro was a significantly higher-cost abater than Inco).

197. See text accompanying note 162 supra.

196. Environment Canada information about actual emission levels in 1980 and the 1994 limits indicates that the amount by which Inco was required to reduce its emissions from 1980 levels (547 kilotonnes) to achieve its 1994 cap of 265 kilotonnes represented approximately 63 per cent of the amount that Ontario was required to reduce total 1980 provincial emissions (873 kilotonnes) in order to achieve the 1994 Ontario cap of 885 kilotonnes. See table on file with author, derived from *1997 Annual Report*, supra note 123 at 5 (major SO₂ sources) and 4 (total SO₂ emissions by province).

However, achieving the ideal least-cost allocation would likely have required imposing an even greater share of provincial emission reductions on Inco. See note 209 infra (referring to Donnan et al.'s retrospective assessment of the costs that Inco and Ontario Hydro incurred in reducing sulphur dioxide emissions). See also Macdonald, *Policy Communities*, supra note 123 at 221-2 ('A 75% reduction by Inco was ... the target in the minds of MOE [Ministry of Environment] and MNR [Ministry of Natural Resources] staff [in 1983].... A 75% reduction to achieve an emissions ceiling of 200 kts would have meant that the least-cost efficiency principle had been applied within Ontario.... At the end of the day, however, the Ontario program only provided for a 265 kt Inco ceiling - the 65 kt difference was made up by Hydro, at a much higher per-tonne cost').

197. See note 194 supra.

198. See text accompanying note 162 supra.

199. Environment Canada information about actual emission levels in 1980 and the 1994 limits indicates that the amount by which Ontario Hydro was required to reduce its emissions (221 kilotonnes) from 1980 levels to achieve its 1994 cap represented approximately 25 per cent of the amount by which Ontario was required to reduce total 1980 provincial emissions (873 kilotonnes) in order to achieve the 1994 Ontario cap of 885 kilotonnes. See table on file with author, derived from *1997 Annual Report*, supra note 123 at 5 (major SO₂ sources) and 4 (total SO₂ emissions by province).

200. Donnan et al., 'Results and Performance,' supra note 123 at 27 ('From the first indications that acid gas regulations would be forthcoming, Ontario Hydro demanded and ultimately received a single emissions cap for the entire firm which it could distribute among five of its fossil plants as it pleased'); Macdonald, *Policy Communities*, supra note 123 at 136 (suggesting that the corporate cap did not represent 'a conscious application of an efficiency-maximizing "bubble" approach ... but [was] ... simply a reflection of Hydro's power, as measured by its ability to avoid intrusion by Ontario into its internal decision-making'); Memorandum from G. Van Volkenburgh, Director, Air Resources Branch, Ontario Ministry of the Environment, to J.W.

Giles, Associate Deputy Minister, Intergovernmental Relations Division, Ontario Ministry of the Environment (29 August 1983) at 2 [unpublished, on file with author] ('Hydro would like to explore ideas such as ... a multi-year averaging scheme for SO₂ limits [, which] ... would enable Hydro to achieve a lower level of SO₂ at a lower cost').

It is noteworthy that in July 1983, Inco suggested that its Manitoba and Ontario facilities should be covered by a corporate cap, in much the same way that Ontario Hydro's generating stations were treated as a unit. However, Inco's request was not 'given serious consideration,' presumably because provincial regulators considered their legal authority to apply only within their own provincial boundaries. See Macdonald, *ibid.* at 220.

Ontario Hydro's ability to obtain a corporate cap that allowed it to trade emissions internally raises the possibility that the intra-provincial allocation of abatement responsibility in Ontario between Inco and Ontario Hydro may have been, in part, a response to Ontario Hydro's political clout. In particular, regulators may have enjoyed a political incentive to impose a smaller reduction on Ontario Hydro than on Inco, in line with their relative abatement costs, because Ontario Hydro was a crown corporation, and the provincial government might have been held politically accountable for price increases or supply disruptions resulting from the imposition of excessively onerous abatement responsibilities on the utility. See Macdonald, *Policy Communities*, *supra* note 123 at 135 ('At least one government official interviewed for this case study saw Hydro during the [early 1980s] ... as "more powerful politically than Inco)'). See generally N.B. Freeman, *The Politics of Power: Ontario Hydro and Its Government, 1906-1995* (Toronto: University of Toronto Press, 1996). But see Macdonald, *ibid.* at 136 (quoting Jim Bradley, Ontario Minister of the Environment for the latter part of 1985 when the Ontario allocation was finalized, as stating that he 'personally never believed anything Hydro ever said').

However, it should be emphasized that Inco also enjoyed considerable influence in Ontario in the 1980s. See *ibid.* at 292 (indicating that Inco avoided a more onerous reduction target because of the firm's 'power'); at 293 (referring to a private meeting in 1985 between then Ontario Premier David Peterson and the Chairman and President of Inco, and another meeting between officials from Inco and Ontario). Furthermore, there were several factors militating in favour of imposing reductions on Ontario Hydro in the 1980s. For example, one internal Ontario government memorandum that I reviewed warned that the provincial government might be perceived domestically as unfairly burdening private sector entities such as Inco with the costs of acid rain control if Ontario Hydro was not also required to reduce its sulphur dioxide emissions. See Memorandum from G. Van Volkenburgh, Director, Air Resources Branch, Ontario Ministry of the Environment, to W.B. Drowley, Executive Director, Resources Management, Ontario Ministry of the Environment (22 June 1982) at 1 [unpublished, on file with author] ('It will look very curious to the public if we go after several commercial concerns with "further cutbacks" but leave a Crown Corporation alone, at a level of 43% reduction, which is not even at the 50% level which Mr. Roberts (and more indirectly) we have touted as being a good "first step"'). A second factor militating against Ontario Hydro was a perception among eastern Canadian regulators in the 1980s that they needed to reduce emissions at power plants to obtain credibility in the United States, where power plants are a considerably larger source of sulphur dioxide emissions than in Canada. See, *e.g.*, Memorandum from D. Haliburton, Commercial Analysis Division, External Strategies Directorate, Environment Canada (11 June 1984) at 7 [unpublished, on file with author] ('The exclusion of thermal power stations from control requirements may have negative repercussions vis a vis U.S. negotiations. They could then argue why they should demand controls from such sources when Canada has excused thermal plants from control requirements'); Memorandum from C. Griffith, Ontario Ministry of the Environment, to File (14 June 1984) at 1 [unpublished, on file with author] ('MOE should consider negotiating with Hydro to expedite [the] ... implementation of

[scrubbers].... In the eyes of the public and some governments, scrubbers represent a tangible commitment to abatement. With scrubbers, Ontario's and Canada's abatement strategy position would be strengthened').

201. See Macdonald, *Policy Communities*, supra note 123 at 218 (referring to Ontario Hydro raising the possibility of a 'multi-year averaging scheme' that evolved into the banking provision).

202. See *Countdown Acid Rain*, supra note 123 at 6 (describing the banking procedure initially made available to Ontario Hydro). See also Nash & Revesz, 'Markets and Geography,' supra note 27 at 586 ('banking is a form of intra-source trade').

203. Macdonald, *Policy Communities*, supra note 123, at 218 n. 478 (noting that '[t]he banking scheme was rescinded by the Ontario government in 1987').

204. Telephone interview with M. Perley, Co-Executive Director, Canadian Coalition on Acid Rain (23 October 2001). According to Mr Perley, the Coalition, the principal environmental group lobbying for reductions in sulphur dioxide emissions in the 1980s, objected to banking by Ontario Hydro. Notably, however, Mr Perley also indicated that the Coalition did not take a position more broadly on emissions trading.

205. See 'The Energy Emissions Crisis,' supra note 7 at 18:44-18:45 (referring to intra-firm trading at Nova Scotia Power and New Brunswick Power, in addition to Ontario Hydro).

206. See D. Burtraw & B. Swift, 'A New Standard of Performance: An Analysis of the Clean Air Act's Acid Rain Program' (1996) 26 *Env'tl.L.Rep.* 10411 ('The cost savings the GAO identifies have been achieved primarily through the new flexibility afforded facilities to choose compliance strategies and *through internal transfers, even in the absence of extensive interutility allowance trading*' [emphasis added]); Swift, 'The Acid Rain Test,' supra note 96.

See also Ellerman et al., *Markets for Clean Air*, supra note 2 at 161 ('the predominant model' between 1995 and 1997 was 'that of internal trading in which overcompliance or excess allowance allocations at some units provide[d] allowances to cover emissions at other units, all within the same year'). But see *ibid.* at 165-6 (warning that it would be misleading to conclude based on allowance allocations and emissions at Phase I units that a significant external market for allowances has not developed).

207. National Center for Environmental Economics, *US Experience*, supra note 3 at 80. I am grateful to Professor Richard Revesz for bringing this point to my attention.

208. *Ibid.* (EPA data demonstrate that through the end of 1999, '[a]bout 62% of ... allowances ... were transferred within organizations, and 38% ... were transferred between organizations'). Several sources of allowances are not included within this EPA data, in particular 'movements of allowances from EPA to the market through auctions, Phase I extension allowances, substitution allowances, and other mechanisms.' *Ibid.*

209. See, e.g., Dewees, 'Regulation of Sulphur Dioxide,' supra note 7 at 144 ('From an economic point of view, however, the [Ontario] Countdown Acid Rain regulations are deficient in a significant way. They do not ensure that the marginal costs of control are equal at all sources, so they do not minimize the cost of achieving pollution control in the province'). Achieving the least-cost configuration of abatement within Ontario likely would have entailed a lower allocation for Ontario Hydro and greater reductions at Inco (and possibly several of the smaller sources in the province).

See also Donnan et al., 'Results and Performance,' supra note 123. Donnan et al.'s retrospective analysis of the Ontario component of the eastern Canada acid rain program provides an indication of the deficiency of the provincial program from an economic perspective. According to figures compiled by Donnan et al., Ontario Hydro's actual expenditures for capital, research and development, and low-sulphur coal for reducing acid rain amounted to \$2 451.5 million between 1985 and 1999. See *ibid.* at Table 10. By comparison, Donnan et al. suggest that Inco's actual expenditures for capital and research and development between 1985 and 1993 amounted to \$743.7 million. See *ibid.* at 23. However, as Donnan et al. emphasize, these figures concerning Inco's and Ontario Hydro's expenditures should be approached with caution. In particular, Donnan et al. identify several grounds for suggesting that these figures overestimate both Inco's and Ontario Hydro's actual expenditures for acid rain abatement. See *ibid.* at 23 and 28. Moreover, the figures for Inco and Ontario Hydro are not directly comparable. For example, the Ontario Hydro figures cover a longer period than the Inco figures.

210. See discussion at Part V *infra*.

211. See text following note 156 *supra*.

212. See Cropper & Oates, 'Environmental Economics,' supra note 1 at 699 ('the compromises and "imperfections" inherent in the design and implementation of incentive-based systems virtually guarantee that they ... will be unable to realize the formal least-cost result'). See also Hahn, 'Political Economy,' supra note 16 at 21-2 (the implementation of effluent fees and marketable permits 'tends to depart substantially from the textbook versions').

213. See text accompanying note 157 *supra* (discussing the potential difficulties with thin pollution markets).

214. Grafton et al., 'Study of a Common-Pool Resource,' supra note 36 at 680. It should be noted that Grafton and his co-authors make an even broader claim, arguing that there have been few empirical studies assessing changes in efficiency following the creation of private property rights in common pool resources in general.

215. See *ibid.*

216. Repetto, *Atlantic Sea Scallop Fishery*, supra note 105.

217. See generally Grafton et al., 'Study of A Common-Pool Resource,' supra note 36. Note that the study was completed before the most recent changes to the halibut regime, which reduced the restrictions on transferability.

218. See, *e.g.*, Repetto, *Atlantic Sea Scallop Fishery*, supra note 105 at 11-2 (discussing changes in fleet size as an indication of improvements in static efficiency); Grafton, 'Canada's Atlantic Fisheries,' supra note 102 at 133-5 (discussing reductions in the number of vessels participating in ITQ fisheries as an indication of improved efficiency). But see R. Russell, 'Cod-Mobile Gear Less Than 65' - 4RS3Pn' in Policy and Economics Branch, Department of Fisheries and Oceans, *Experience with Individual Quota and Enterprise Allocation (IQ/EA) Management in Canadian Fisheries, 1972-1994* (November 1994) Part B, 1 at 4 ('the number of vessels is a crude measure of capacity, which can often be more than offset by increases in the catching capacity of individual vessels').

219. Archipelago Marine Research, supra note 80 at Table 1.

220. *Ibid.*

221. Liew, 'Measurement of Concentration,' supra note 66 at 280.

222. Ibid. at 14. The decline in the stocks covered by the Scotia-Fundy regime after the program was implemented underscores the fact that individual quota programs 'are designed to achieve economic goals, not biological ones.' N. Roy, 'What Went Wrong and What Can We Learn from It?' in D.V. Gordon & G.R. Munro, eds., *Fisheries and Uncertainty: A Precautionary Approach to Resource Management* (Calgary: University of Calgary Press, 1996) 15 at 22. As Roy explains, individual quotas 'are designed to maximize the economic rent obtained from a given level of harvesting. For this to be successful,' regulators 'have to get the global quota right.' Ibid. at 22.

Indeed, there are instances, in addition to the Scotia-Fundy regime, in which regulators have been overly optimistic about underlying resource conditions in establishing the TAC on which individual quota programs are premised. As a result, important fisheries have been depleted, even while subject to individual quotas, because global quotas have been excessive. These fisheries include the offshore groundfishery in Atlantic Canada and the otter trawl cod fishery in the Gulf of St. Lawrence. See *ibid.*; E.M. Iacobucci, M.J. Trebilcock, & H. Haider, *Economic Shocks: Defining the Role of Government* (Toronto: C.D. Howe Institute, 2001) at 184-207 (the East Coast cod fishery collapsed as a result of government mismanagement, which partly took the form of establishing excessively high annual global quotas). See also Roy, *ibid.* at 22-3 (discussing whether individual quotas 'positively contributed' to the depletion of cod stocks by encouraging fishers to discard lower-value fish).

223. See A. Krajnc, 'Whither Ontario's Environment? Neo-Conservatism and the Decline of the Environment Ministry' (2000) 26:1 Can.Publ.Policy 111 (discussing the environmental policies of the Ontario Conservative government). See also Keohane et al., 'Choice of Regulatory Instruments,' supra note 2 (distinguishing demand and supply analyses of the choice of environmental policy instrument).

224. Ontario, Ministry of the Environment, Environmental Registry Posting Number RA00E0004, 'Emission Limits for Ontario's Electricity Generators and Other Major Sources' (24 January 2000), online: Environmental Registry <<http://204.40.253.254/envregistry/012921er.htm>> (last modified: 26 March 2001) (announcing Ontario's intention to establish pollution markets for sulphur dioxide and nitrogen oxides). The statutory basis for the regulations establishing the provincial pollution markets is the *Environmental Protection Act*, R.S.O. 1990, c. E.19, as am. by S.O. 1990, c. 15, Sch. E, s. 10.

225. Under an *allowance* regime, regulators establish a total allowable cap on emissions. In turn, allowances (or emission rights) are allocated to polluters, adding up to the cap, and polluters are allowed to exchange these rights. Under an *emission reduction credit* regime, there is no aggregate cap on emissions. Instead, individual sources generate credits by reducing their emissions below a baseline, such as their individual, source-specific emission rates. Sources then bank these credits for their own use or sell them to other polluters. Sources are motivated to bank credits, or to sell them, in order to reduce the costs of complying with regulatory requirements. See Stavins, 'Market-Based Policy Instruments,' supra note 4 at 15.

226. In designing the method for allocating allowances, Ontario was required to take into account the implications of introducing emissions trading while simultaneously encouraging competition in the electricity generating sector, which remains dominated by Ontario Power Generation. See Ontario, Ministry of the Environment, *Emissions Reduction Trading System in Ontario: A Discussion Paper* (2001) at 20-3 [hereinafter *Ontario Discussion Paper*]; L. DeMarco, 'RA1E0009 Ontario Ministry of the Environment Consultation on the Ontario Air

Emissions Framework Emissions Trading Discussion Paper: Submissions of the Clean Electricity Markets Group' in Ontario, Ministry of the Environment, *Public Comments: Reduced Emission Limits for the Electricity Sector and an Emissions Reduction Trading System for Ontario Discussion Paper*, vol. 2 (2001) at 11-7 [unpublished, on file with author] (criticizing the method for allocating allowances outlined in the March 2001 discussion paper); Environmental Registry Posting Number RA01E0020, *supra* note 10 (outlining changes to the proposed method for allocating allowances).

227. Ontario, Ministry of the Environment, Environmental Registry Posting Number PA01E0026, 'Emission Reductions From Ontario's Industrial Sources' (24 October 2001), online: Environmental Registry <<http://204.40.253.254/envregistry/017127ep.htm>> (last modified: 24 October 2001); Ontario, Ministry of the Environment, Environmental Registry Posting Number RA01E0009, 'Reduced Emission Limits for the Electricity Sector and an Emissions Reduction Trading System for Ontario' (26 March 2001), online: Environmental Registry <<http://www.ene.gov.on.ca/envregistry/015728er.htm>> (last modified: 31 July 2001); Ontario, Ministry of the Environment, News Release, 'Ontario Launches Tough Actions to Improve Air Quality' (26 March 2001), online: Government of Ontario Press Releases <<http://www1.newswire.ca/government/ontario/english/releases/March2001/26/c6815.html>> (date accessed: 14 May 2002).

Notably, in September 2001, Ontario announced new limits on total allowable emissions of sulphur dioxide from Inco and Falconbridge, to take effect in 2007. However, Inco and Falconbridge will not be able to achieve these caps through emissions trading, although they may be able to generate credits for sale if they reduce their emissions by more than their regulated limits. Ontario, Ministry of the Environment, Environmental Registry Posting Number IA01E1207, 'Inco Limited Order For Controlling Contaminant Discharge' (11 September 2001), online: Environmental Registry <<http://204.40.253.254/envregistry/016781ei.htm>> (last modified: 12 February 2002) (announcing control order for Inco, which will limit Inco's annual sulphur dioxide emissions to 175 kilotonnes effective 1 January 2007); Ontario, Ministry of the Environment, Environmental Registry Posting Number IA01E1208, 'Falconbridge Limited Order For Contaminant Discharge' (11 September 2001), online: Environmental Registry <<http://204.40.253.254/envregistry/016782ei.htm>> (last modified: 12 February 2002) (announcing control order for Falconbridge, which will limit Falconbridge's annual sulphur dioxide emissions to 66 kilotonnes, effective 1 January 2007).

228. See *Ontario Discussion Paper*, *supra* note 226 at 25.

229. O. Reg. 397/01, s. 18(2). But see O. Reg. 397/01, s. 18(3) (emission reduction credits created in other jurisdictions might be recognized if the emission reductions 'have a measurable effect in Ontario').

230. In contemplating purchases by Ontario sources of credits in the United States, Ontario's proposed regime represents a partial step in the direction of transboundary trading. The step is only partial, however, because the regime does not envision Ontario sources selling credits (or allowances) to US sources, or, more importantly, Ontario and US sources bound by a single regime with a comprehensive North American cap on emissions.

Canadian policy makers have considered transboundary trading at least since the early 1990s, although I have not come across any specific government proposals for operationalizing a transboundary regime. See, *e.g.*, *Economic Instruments for Environmental Protection*, *supra* note 131 at 30; 'The Energy Emissions Crisis,' *supra* note 7 at 18:46. For academic discussion of transboundary sulphur dioxide trading between Canada and the United States see L.T.M. Bui, 'Gains from Trade and Strategic Interaction: Equilibrium Acid Rain Abatement in the Eastern United States and Canada' (1998) 88 *Amer.Econ.Rev.* 984; Menz, 'Transborder

Emissions Trading,' supra note 157.

Transboundary trading is attractive from a Canadian perspective partly because it might generate increased cost savings, relative to an Ontario- or a Canadian-only regime, by increasing the number of participating sources with varying abatement costs. See *Economic Instruments for Environmental Protection*, *ibid.* Transboundary trading also has an environmental basis, given the proportion of air pollution in Canada that originates in the United States. See, e.g., *Coal-Fired Generation in Ontario*, supra note 164 at 9-10 (US emissions of NO_x 'are responsible for about half of the ground level ozone experienced during episodic conditions in Ontario,' and US SO₂ emissions 'are responsible for 50-60 percent of the airborne sulphate in the greater Toronto and Hamilton areas').

Notably, the United States Environmental Protection Agency (EPA) recently seems to have demonstrated an interest in pursuing transboundary trading with Canada to reduce ozone levels. However, in June 2001, the EPA expressed concerns about the adequacy of the methods for monitoring emissions under Ontario's proposal, as well as about the possibility that Ontario's proposed regime might allow aggregate emissions to increase. See letter from B.J. McLean, Director, Clean Air Markets Division, United States Environmental Protection Agency, to J. Hutchison, Senior Policy Advisor, Air Policy and Climate Change Branch, Ontario Ministry of the Environment (22 June 2001) [hereinafter Mclean Letter].

231. See Environmental Registry Posting Number RA01E0020, supra note 10 ('in order to create a market large enough to make trading feasible, and in the absence of a formal cross-border trading agreement, Ontario has created an innovative system that combines the best features of allowance as well as credit trading').

It is difficult to determine the extent to which the Ontario government's concern that there may be an insufficient number of sources with sufficient variations in abatement costs in the province is warranted, since the Ontario Ministry of the Environment does not seem to have assembled information on the abatement costs and pollution-control options of individual sources comparable to that assembled in the early 1980s. See, e.g., Ibbitson, 'Clean-Air Measures,' supra note 128 (noting that the Ontario government has stated that it has not calculated the cost of recent announcements concerning the environment).

232. See, e.g., 'Smog and Mirrors' *The Toronto Star* (27 March 2001) A22; J. Gibbons, *Ontario Clean Air Alliance, Weak Emission Limits: An Assessment of Ontario's 2001 Proposals for Air-Pollution Control in the Electricity Sector* (Toronto: Ontario Clean Air Alliance, 2001) at 5 [hereinafter *Weak Emission Limits*]; McLean Letter, supra note 230 ('we are concerned that emissions will increase under the program if new sources of emissions are not covered by the cap (or required to offset their emissions), or if ERCs [emission reduction credits] can be earned where emissions increase. If emissions are allowed to grow after their initial reduction, then the environmental improvements will not be sustained' [emphasis added]); Canada, Environment Canada, 'Comment to the Ontario Government on Environmental Bill of Rights (EBR) Registry No. RA01E0009: Reduced Emission Limits For the Electricity Sector and an Emission Reduction Trading System for Ontario' in Ontario, Ministry of the Environment, Public Comments: Reduced Emission Limits for the Electricity Sector and an Emissions Reduction Trading System for Ontario Discussion Paper, vol. 1 (2001) at 24 [unpublished, on file with author] [hereinafter 'Comment to the Ontario Government'] ('the idea of a rate-based approach [for setting the baseline for the creation of credits] would undermine the cap and allowance program by allowing evading of the cap and credits to be created even though overall emissions are increasing').

233. In other words, selling sources will not be opting into the trading program in a manner

comparable to the way that units voluntarily opted into the US sulphur dioxide trading program in Phase I and then, in effect, became Phase I-affected units. See Ellerman et al., *Markets for Clean Air*, supra note 2 at 197-220. The key distinction is that under the Ontario program, the sources are merely selling credits to covered sources. The selling sources do not themselves become covered sources upon completing a sale.

The Ontario government's stated reason for not proposing a cap on the emission levels of credit sellers as of the date of the sale is a concern that imposing such a cap would negatively affect economic growth. See *Ontario Discussion Paper*, supra note 226 at 25-6 (using emission levels to calculate the baseline for credits would not 'allow for economic growth').

234. A source's *emission level* is the source's aggregate volume of emissions for a given period of time, such as tonnes per year. A source's *emission rate* is the source's emissions, again by volume, but measured per unit of input or output rather than for a given time period. For example, a thermal power plant's emission rate might be defined as the volume of SO₂ the plant discharges in proportion to heat input or to power output. See, e.g., D.N. Dewees, 'Price and Environment in Electricity Restructuring' (Canadian Law and Economics Association Annual Conference, University of Toronto Faculty of Law, September 2001) at 18 [unpublished] [hereinafter 'Price and Environment'] (describing federal and Ontario guidelines for emissions from thermal power generation and stationary combustion turbines).

235. To address the danger that aggregate provincial emissions may increase as a result of credit trading, Ontario's regime includes several elements intended to limit the use of credit trading. These include a cap on the use of credits, a 10 per cent discount on credits used, and a limit on the life of credit creation. See Ontario, Ministry of the Environment, *Emissions Trading and NO_x and SO₂ Emissions Limits for Ontario's Electricity Sector: A Technical Description of the Regulation* (19 October 2001) at 5, online: Environmental Registry <http://www.ene.gov.on.ca/envision/env_reg/er/documents/2001/RA01E0020-C.pdf> (date accessed: 19 May 2002) [hereinafter *Emissions Trading Technical Description*].

236. See note 223 supra and accompanying text.

237. Environmental Registry Posting Number RA01E0009, supra note 227. See also Environment Canada Backgrounder, supra note 127; 'Ozone Annex,' supra note 127.

238. *Coal-Fired Generation in Ontario*, supra note 164 at 33. See also D. Dewees, 'Hydro Restructuring and the Regulation of Conventional Pollutants' in R.J. Daniels, ed., *Ontario Hydro at the Millennium: Has Monopoly's Moment Passed?* (Montreal: McGill-Queen's University Press, 1996) 169 at 175.

239. See *Coal-Fired Generation in Ontario*, supra note 164 at 18 (1999 emission levels); *Emissions Trading Technical Description*, supra note 235 at 3 (setting out declining caps on NO_x emissions from 2001 to 2007); Gibbons, *Weak Emission Limits*, supra note 232 at 2 ('The proposed caps for 2001 and 2007 represent cuts of 7% and 53% respectively from [Ontario Power Generation's] ... actual NO emissions from its fossil fuel plants in 1999').

One question with respect to the new NO_x targets is whether they will be sufficiently stringent to satisfy Canada's obligations under the Ozone Annex. See J. Spears, 'Smog Plan Not Enough' *The Toronto Star* (26 October 2001) A17; D. Bueckert, 'Clean-Up Deadline for Coal-Fired Plants' *The Toronto Star* (28 November 2001) A23.

240. 'Ontario Launches Tough Actions to Improve Air Quality,' supra note 227 (as of 2007, the cap on SO₂ emissions will be 25 per cent lower than the 1994 cap).

241. Gibbons, *Weak Emission Limits*, supra note 232 at 1.

242. See *Coal-Fired Generation in Ontario*, supra note 164 at 18 (1999 emission levels); *Emissions Trading Technical Description*, supra note 235 at 3 (setting out declining caps on SO₂ emissions). See also Gibbons, *Weak Emission Limits*, supra note 232 at 1 (using tonnes rather than kilotonnes, and arguing that '[t]he proposed annual cap for 2007 is virtually equal to OPG's actual sulphur dioxide emissions in 1999').

243. See 'Comment to the Ontario Government,' supra note 232 at 15-16 (discussing the expectations for growth in fossil fuel-fired electricity generation used in calculating the Ontario NO₂ emission cap commitment under the Ozone Annex).

244. See text accompanying note 108 supra.

245. Cropper & Oates, 'Environmental Economics,' supra note 1 at 730.

246. Ibid.

247. Ibid.

248. Ibid.

249. See text accompanying note 162 supra.

250. Ontario, Ministry of the Environment, Fact Sheet, 'Ontario's Clean-Air Plan For Industry' (24 October 2001), and attachments concerning provincial and industrial sector emissions of nitrogen oxides in 1999 [hereinafter 'Fact Sheet']. See also *Coal-Fired Generation in Ontario*, supra note 164 at 8 (in 1999, transportation sources accounted for 43.5 per cent of NO_x emissions; off-road engines including snowmobiles, all-terrain vehicles, and construction equipment accounted for 19.9 per cent; electricity generation by Ontario Power Generation contributed 14.7 per cent; and '[t]he remaining 22 per cent [was] ... the result of a large variety of industrial, commercial and residential emitters'). The Criteria Air Contaminant Emission Summary for nitrogen oxides in 1995 provides another breakdown of the sources of nitrogen oxides in Ontario. See also Environment Canada, Criteria Air Contaminant Emission Summaries, 1995 Nitrogen Oxides (NO_x) Emissions by Province (Tonnes), online: Environment Canada <http://www.ec.gc.ca/pdb/ape/ape_tables/nox95_e.cfm> (last updated: 14 February 2002).

251. See 1998 Ontario's Top 25 NO_x Emission Sources, included in e-mail from S. Wong, Emission Inventory Models Engineer, Environmental Modeling and Emissions Inventory, Ontario, Ministry of the Environment, to K. Wyman (28 September 2001) (listing the top twenty-five sources of NO_x emissions in Ontario).

252. See D.N. Dewees, 'Emissions Trading: ERCs or Allowances' (2001) 77 *Land Econ.* 513 at 524; Dewees, 'Price and Environment,' supra note 234 at 20.

253. *Coal-Fired Generation in Ontario*, supra note 164 at 10.

254. See 'Fact Sheet,' supra note 250 (indicating that Ontario is moving to ensure that 'major industrial sectors make their fair-share contribution to reducing' SO₂ (and NO_x) emissions and that '[t]he government is planning to expand its system of emissions reduction trading for the electricity sector to include other major industrial sectors'). In addition, Ontario is initiating consultations on changes to the regulations governing the sulphur in fuel oil and coal, with a

view to reducing SO₂ emissions from small industrial and commercial sources that burn fuel oil and coal. See Environmental Registry Posting Number PA01E0026, *supra* note 227.

255. See *Ontario Discussion Paper*, *supra* note 226 at 20-1 (referring implicitly to the connection between the introduction of emissions trading and the sale of Ontario Power Generation's coal-fired power plants).

See generally M.J. Trebilcock & R. Daniels, 'Electricity Restructuring: The Ontario Experience' (2000) 33 *Can.Bus.L.J.* 161 (describing key features of the competitive electricity market designed for Ontario by the Market Design Committee, including the requirement that Ontario Power Generation transfer effective control of a significant portion of its generating capacity to mitigate its existing market power). See also M. Mittelstaedt, 'Bruce Deal Is Sweet, Records Reveal' *The Globe and Mail* (29 October 2001) A14 (referring to the Ontario rules requiring Ontario Power Generation to reduce its share of the market and indicating that Ontario Power Generation 'is trying to follow up the [lease of the Bruce nuclear complex] ... with the sale or lease of several of its coal-fired and hydro power stations').

256. See Market Design Committee, *Second Interim Report of the Market Design Committee to the Honourable Jim Wilson, Minister of Energy, Science and Technology* (30 June 1998) at 5-3, online: Independent Electricity Market Operator <http://www.theimo.com/imoweb/historical_devel/Mdc/Reports/InterimReport2/chapter5.pdf> (date accessed: 17 May 2002) ('Existing regulations that pertain only to Ontario Hydro no longer will be adequate in the newly competitive electricity market. The White Paper contemplates, and the MDC expects, vigorous competition in generation, with the market share of generation controlled by Ontario Hydro's electricity generation business ... falling over time. We anticipate that private companies will develop new generation capacity. Therefore, the structure of the regulations that apply to Ontario Hydro must be re-examined'); Environmental Registry Posting Number RA01E0020, *supra* note 10 (existing 'Regulation 153/99 does not accommodate new/multiple owners of [Ontario Power Generation's six fossil fuel-fired] ... stations and does not accommodate new stations expected to be built in Ontario').

257. See generally R.B. Stewart, 'Environmental Contracts and Covenants: A United States Perspective' in J.M. van Dunne, ed., *Environmental Contracts and Covenants: New Instruments for a Realistic Environmental Policy?* (Rotterdam: Institute of Environmental Damages, Erasmus University, 1993) 143 at 157 (referring to the implications of legal and administrative cultures for the choice of instrument).

258. G. Van Calster & K. Deketelaere, 'The Use of Voluntary Agreements in the European Community's Environmental Policy' in E.W. Orts & K. Deketelaere, eds., *Environmental Contracts: Comparative Approaches to Regulatory Innovation in the United States and Europe* (Cambridge, MA: Kluwer Law International, 2001) 199 at 243 (more than 100 agreements have been concluded in the Netherlands).

259. G. Klaassen, 'Practical Experience, International Agreements and the Prospects for Emission Trading in CEE' in P. Kaderják & J. Powell, eds., *Economics for Environmental Policy in Transition Economies* (Lyme, NH: Edward Elgar, 1997) 90 at 95-6; E. Orts & K. Deketelaere, 'Introduction: Environmental Contracts and Regulatory Innovation' in E.W. Orts & K. Deketelaere, eds., *Environmental Contracts: Comparative Approaches to Regulatory Innovation in the United States and Europe* (Cambridge, MA: Kluwer Law International, 2001) 1 at 6-7.

260. For a brief analysis from the 1990s of the efficiency of aspects of air pollution regulation in several European countries, see Klaassen, *Acid Rain*, *supra* note 183 at 157-65 (discussing in general terms the potential cost savings from national quotas for SO₂ and NO_x emissions for

power plant companies in Denmark, the 1990 covenant establishing national ceilings for SO₂ and NO_x emissions from power plants in the Netherlands, bubble and averaging concepts used to regulate refinery sector emissions of SO₂ in the Netherlands, and two provisions allowing the transfer of emission reduction obligations in Germany).

261. See notes 4 and 8-9 supra.

262. See notes 4 and 8-11 supra.

1356987

Copyright 1992-2003 University of Toronto Press Incorporated except where otherwise noted. All rights reserved. Redistribution of the files in this site through electronic means (such as Web servers, FTP servers, or electronic mail) is expressly prohibited. Except as outlined above, these documents (or parts thereof) must not be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without prior permission of the publisher. Every effort has been made to contact copyright holders of material included in this site. If your article appears here without your permission, please let us know and we will remove it. Contact [Anne Marie Corrigan](#). [Legal Notice](#)